Ministry of General and Professional Education
RUSSIAN FEDERATION
Tomsk Polytechnic University

GV Nikolaev

Modern electrodynamics and causes a paradoxical

PROSPECTS constructing a consistent Electrodynamics

Theory, experiment, paradox

Second Edition, Revised

UDC 537.6 / 8 550.38

H632

ISBN 5-88839-045-3

Tomsk
2003

Taken here , digitized January 2010

TOMSK POLITECHNICAL UNIVERSITY

Gennady V. Nikolaev

MODERN ELECTRODYNAMICS AND REASONS OF ITS PARADOXICALLY
PROSPECTS OF CONSTRUCTION OF NOT INCONSISTENT ELECTRODYNAMICS

Theories, Experiments, Paradoxes

This book is devoted to analysis of the fundamental base of classic and modern

FOREWORD (by Stefan Marinov) (used by Nikolaev in his book)

(Source of the Foreword: http://bourabai.ru/nikolaev/electro01.htm)

We will not argue, we calculate ...

Gottfried Wilhelm Leibniz

*... **and measure.***

Gennady Nikolaev

Gennady Nikolayev and I met at the II International Conference on space, time and gravity in St. Petersburg in September 1991, but some of his most interesting preprints I read a quarter of a century ago, when I lived in Bulgaria. During the conference, we spent more time in my room at the "Leningrad" than in the conference room, for spent Nikolaev and some other Russian physicists experiments, which he told me were a hundred times more interesting than the reports at the conference.

Any physics student, faced with electromagnetism, notes that there is "something wrong", but under the influence of authority of textbooks and professors every student tries any contradictions and absurdities "sweep under the carpet," as all the authors of textbooks and all the professors did the same as when they themselves were students.

My "ferment" lasted much longer, and under the influence of remarkable experiments on electromagnetic induction Cuban physicist Francisco Muller and my own on the measurement of the absolute velocity of the Earth, rejects the principle of relativity and equivalence, I began to finally tempered ikonoklastom. But I must say that, although I have several times refused the Lorenz equations, Grassmann and again raised his flag on it, by 1991, this equation was I firmly accepted as true.

And Nikolaev experiments showed me that in no way could be linked to the Lorentz equation (Grassmann name will be omitted). *I* literally lost sleep and rest and Nikolayev said: "Gennady, I built the whole" my "electromagnetism on the Lorenz equations, I was able to bring his impeccable logic of mathematical equations Coulomb and Neumann on electric and magnetic energy of two charges, and now you show up with their experiments that they say, This equation is not true! That restructuring, which started you in your kingdom-state, is nothing compared the restructuring, which you cause in electromagnetism. I find it hard to reshape my books: I'm old, I'm tired. " Nikolaev said, "The sooner you rebuilt, the easier it will attain salvation. Do not rebuilt - do not you will be saved!" And, back in Graz, I began to "rebuild". Again felt again the derivation of formulas, compared with experiments. Then he repeated some of the

experiments Nicholas. The effects were the same as that described Nikolaev in his monograph in 1986, tapped on a typewriter, which he kindly gave me. This monograph for an improved form of the reader holds in his hands now.

Thus, the equation of Lorentz "bursting at the seams." A cylindrical magnet that axial plane cut in half, and one half is inverted (magnetic forces make it inverting yourself) creates a cutting plane near the magnetic field which acts on the current longitudinal forces (according to the equation of Lorentz force, which acts on the magnet currents always perpendicular to the latter). This field Nikolaev called scalar magnetic field, and the above-described magnet in honor of Siberian Nikolayev I called Siberian KOLYA (SIBERIAN COLIU - give its English transcription, because the magnet is much more known in English literature than in Russian). It turned out, it means: for two hundred years of electromagnetism mankind has not noticed that, besides the magnetic field B, which we call the vector magnetic field, there is a scalar magnetic field S. So at the current element ***I****dr* are two forces, Lorentz and Nikolaev.

$F = F_{lor} + F_{nic} = Idr \times B / c + Idr\, S / c$.

But the most interesting result, which is the scalar magnetic field is as follows. Everyone knows that when using the first three fingers of the right hand can be shown that if a piece of wire with sliding contacts at its ends to move in a plane perpendicular to the magnetic field vector B in the direction perpendicular to the wire, the current is induced in such a direction that interaction of this field with the induced current in the leads to the inhibition of the wire. This is a well-known law of Lenz, the first term in the above formula gives its mathematical justification. If, however, with only one finger right or left hand reader will try to establish which will induce a current in a wire with sliding contacts, which he will move in the direction of the wire in a magnetic field with a scalar S, then, to my amazement, the reader will find that the induced current will not slow down the movement of the wire, and will help her move. This can be called antilents effect. Of this effect, which the reader can immediately be verified experimentally, if at hand magnet SIBERIAN Kolya, it follows that using scalar magnetic field can build perpetual motion. I think this will be enough to become clear to the reader what to do Gennady Nikolayev in electromagnetism.

Express the vector magnetic field B through the electric charges q_i Vi their speed and distance from the observation point Ti is very easy, if you enter the vector magnetic potential A, for

$$\mathbf{B} = \mathrm{rot}\,\mathbf{A} = \mathrm{rot}\sum q_i \mathbf{v}_i / c r_i .$$

But express S in terms of qi, Vj and rj was not so easy. The formula for S, which I proposed and which to this day has not entered into conflict with any of the experiments I know where there is a longitudinal movement of a piece of wire or induction currents in the longitudinal motion piece of wire, the following:

$$S = -\mathrm{div}\,A - \sum_i (q_i \mathbf{v}_i \cdot \mathbf{n})(\mathbf{r}_i \cdot \mathbf{n})/cr_i^3 ,$$

where *n = dr / dr* - unit vector in the direction of the current element Idr. It is possible that this formula should take a factor of "1/2". All I know of experiments on longitudinal movement of the wire, including my own, are of good quality, and yet the presence or absence of the coefficient "1/2" is not set.

I should note that the first who observed at the beginning of the century the longitudinal motion of a piece of wire with sliding contacts, is an American engineer Carl Hering. These effects are described in his review article in the American Journal TRANS. AM. INST. EL.ENG., 42, 311 (1923), which I reprinted in my journal DEUTSCHE PHYSIK, 1 (3), 41 (1992).

The last three years of my experimental and theoretical work, in addition to efforts to launch a perpetual motion magnet SIBERIAN Kolya, were devoted to the correct conclusion of the fundamental equations of electromagnetism, which should replace the wrong Lorentz equation. The first equation, which I proposed and named in honor of Nikolayev Mykolaiv equation that already contains a scalar field S in the above form. *I* sent this equation Nikolaev. He spoke critically. Taking into account the guidance of the "leader", I suggested a new equation is called the second equation of Nikolaev. Nikolaev with this equation as if agreed, but wrote me in a letter that equation, I suggest, should be called by its name. Soon I will put experiments (see. DEUTSCHE PHYSIK, 3 (11), 5 (1994)), which is in contradiction with the first and second equations Nikolaev (these names I keep to this day, because once the baby is named Ivan, the can not be when he's a year old, began to call him Peter). Then, in late 1993, I proposed a new equation that described by the Marinov equation. It was a beautiful elegant equation is simple symmetrization was obtained from the equation Grassmann, ie from the Lorenz equations, and three years I thought this equation, all effects due to the scalar magnetic field S, which is equal to the above value, multiplied by a factor of "1/2".The journal DEUTSCHE PHYSIK reader will find accurate calculation of the scalar magnetic field generated by an infinitely long cylinder and ring magnets SIBERIAN Kolya, which are the basic elements of perpetual motion machines working on the scalar magnetic field.

But a month ago, I set up an experiment, which is in contradiction with the Marinov equation, because this equation, in addition to the vector magnetic field B, input, and other vector magnetic field B_{Mar} , which in the experiments were found.

Since the question of what should be the fundamental equation in electromagnetism, is a matter of great importance and since I was unable to find this equation, I announced a contest with a prize of $ 100 000. This contest will be announced in the near future in the American Journal GALILEAN ELECTRODYNAMICS and journal DEUTSCHE PHYSIK.

Conditions of competition are as follows:

I pay $ 100 000 to the researcher, who will offer the formula (usually scheme), with whose help it will be possible to count the power and torque (with respect to an arbitrary axis) that closed circuit with a current I_i acts on the other closed loop with current I or on the side of the latter, associated with the sliding contacts rest. The money will be paid, if I'm not able to demonstrate an experiment that would enter into conflict with this formula. If the applicant does not agree that my "kontreksperiment" is falsifying, it may file an objection, and editor GALILEAN ELECTRODYNAMICS should appoint a committee of three university professors, who must decide whether or not my experiment falsifying or not. If a majority of the Commission request that the experiment is not falsifying, I'll pay the aforementioned amounts, and 2 000 dollars to each of the committee members. However, if the Commission decides that the experiment is falsifying, the applicant does not receive anything, but will have to pay for 2000 dollars to each of the professors.

I call on all Russian physicists strain minds. $ 100 000 - this is almost a Nobel prize and will be awarded for the work, not the phantasmagoria. While task that I set, it seems extremely simple. But it only seems that way! Otherwise 100,000 dollars out of my pocket, I would not pull out.

In concluding this preface, I can only say the following. Although Nicholas has published many articles in Russian physics journals, his name and his revolutionary discoveries known much more in the West (Japan include in the "West"), than in Russia. Let us hope that the publication of this monograph will help Russian physicists and electrical engineers to quickly understand what the torch was lit in Siberia.

Stefan Marinov,

director of the Institute for Fundamental Physics,

city Graz, Austria

TABLE OF CONTENTS

Dedicated tragically deceased Austrian physicist, active revolutionary new directions in science, near and dear to many of us, a prominent scientist Stefan Marinov.

FROM THE AUTHOR

For the birth of new theories and new ideas in science, as we know, the need for objective reasons. If in any field of knowledge, we would have, for example, the ideal theory that would meet absolutely all the questions, it is unlikely that anyone found a desire to change this theory or something to complement and improve it. Another thing, if in any known theory show up at least some small contradictions or inconsistencies, such as the obvious facts or experimental results. Then the inquisitive mind of man certainly will certainly try to somehow remove these contradictions somehow get rid of them. It was then and there that the objective necessity to supplement, correct, and if it does not, even in something changed or completely subvert the well-known theory.

If we turn to the modern theory of electromagnetism as a particular scientific theory, it is just hard to talk about some inconsistencies and contradictions, since this theory is almost completely riddled with all sorts of contradictions and paradoxes. Moreover, many paradoxes of electrodynamics assigned even their own names: "Paradoxes of unipolar induction", "Secrets of unipolar induction," "paradox unipolar motor," "paradox railgun engines", "Goering paradox", "paradoxes transformer" and so on. D. and so on. n. In other words, reason, and quite serious, in electrodynamics abound, but oddly enough, no

serious attempts to change or add to the well-known theory of electromagnetism hitherto virtually been taken. Here does not refer to the initial period of the electromagnetic theory, when such attempts was enough. The reason for this was not only already known at the time the contradictions and paradoxes of electromagnetic theory, but also, to a large extent, applied Maxwell abstract mathematical formalism describing the various electromagnetic phenomena through the electric and magnetic fields. The foundations of this formalism were laid by numerous experimental studies of Faraday and his followers, proves the possibility of the existence of a moving electric charge, except for the electric field, which is registered in the state of charge in his quiet, even the magnetic field as a kind of self-physical entity. Over time, the positive virtues of electromagnetic theory, which, undoubtedly, were overshadowed by its shortcomings and weaknesses. Contradictions and paradoxes in the theory came to be regarded as merely strange and harmless exceptions coherent theory. Played a significant role in the excessive mathematization theory. The consequence of this excessive mathematization of the theory was the obvious fact that the modern theory of the electromagnetic discharge physical theory has become essentially a purely mathematical theory.

Proponents of formal mathematical methods considered and assure that in mathematical equations and curves of modern electromagnetic theory in their conventional recording all expressed the physical nature of the laws of electrodynamics. However, in reality, attempts physical interpretation of specific phenomena of electromagnetism encounter somehow insuperable difficulties. You can of course mathematical symbols in equations ascribe some physical properties and quantities are as actually practiced. For example, the symbols **E** and **H,** respectively called the electric and magnetic field, endowed with the property of having a material impact on the other symbol **q** - electric charge in his state of rest or motion, but what is the real nature of the field **E** or **H,** what is the physical nature of the possibility of charge at a distance to work on other charges, and that is a very electric charge - the answer to these questions some mathematical symbols equations of the theory can not give. Modern mathematize electromagnetic theory in the form of elegant beautiful can write the equation of electromagnetic induction, but in principle, it can not answer the question of what the physical causes are responsible for the appearance of the vortex electric field **E** at the points of the space in which or around which changes the physical parameter field **H.** It remains unclear what specific physical causes are responsible for the phenomenon and what specific physical processes taking place in the space, which changes the magnetic field **H** or field vector potential **A,** and so on. D. Proponents of the purely mathematical methods in electrodynamics is proud to say that in any "physical "theories are mainly rigor, complete the form and graceful look of mathematical equations. But how to obtain these equations, some of the premises and physical concepts used in their justification and what assumptions have been made in their derivation, and so on. D. - All these really important physical factors theory supporters of mathematical methods in general seems to be no longer interested. All this they call "scaffolding" that should not even remember not to spoil the facade of the building a "theoretical building" theory. Meanwhile, to be objective, any specialist physics should be interested above all these "scaffolding", which provide the physical essence of the original theory and that is just and deepen our knowledge of the inner physical nature of the phenomena described. Without objective physical approach is not possible and a further deepening of our knowledge at all about all the laws of nature. Moreover, if the essence of "physical theory" to limit the severity and complete notation of differential equations of the theory of linking a number of "physical" parameters of the theory **E, H, q,** and r. E. To each other, then all meaningless question of clarifying the nature of themselves "physical "parameters and their actual (rather than analytic!) physical relationship and material essence. All these questions when already identified the main quantitative relationships between the "physical" parameters are clearly beyond the boundaries of the bare mathematical formalism of the theory, which defines the severity and the final form of the equations considered "physical" theory. And, just freed from captivity naked mathematical formalism and constantly mindful of the fact that the mathematical relationships and equations in the theory - it is only auxiliary and only symbolic methods reflect the actual physical

processes between material objects and environments, you can really get close to revealing the physical nature of the studied real phenomena.

Offers a popular set overview attempt to attract the attention of a wide circle of specialists in different fields of science and technology and the wider scientific community to the current state of electrodynamics extremely controversial with both physical and mathematical point of view, a paradoxical situation. On the other hand, and this should have openly declare the inertia of established thinking in modern electrodynamics, cherished by the ruling and deeply rooted in the science of ideas, now so great that there are already big doubts about the possibility of painless and rapid changes in the existing electrodynamics intolerable situation . However, the current situation in science is such that an obvious need for radical changes in modern electrodynamics, deepening our general knowledge about the laws of electromagnetism and accounting reality of the existence of at least one more type of magnetic field and another type of magnetic interaction is so significant that any further delay and delay the natural process of improving our knowledge and change rooted in the electrodynamics of bounded and misconceptions in the general progressive movement to progress, can only significantly increase and complicate the already serious and critical situation in modern science. And if you take into account that the introduction of the electrodynamics of another type of magnetic field and another type of magnetic interaction, with a corresponding significant change in the original system of differential equations of electrodynamics, is only the initial and immediate surgical half measures necessary radical changes throughout the foundations of modern physics, a further procrastination and delay the process of fundamental change in the basis of modern physics can lead to catastrophic consequences.Even now due to limited initial concepts in modern electrodynamics mankind has been forced to spend huge amounts of money to overcome those technical difficulties encountered practical human activity. And these senseless costs of intellectual, technical, economic and financial capacity of society to our stressful as technical and economic age, which could have been avoided, will progress rapidly and even more aggravate the already difficult economic situation of the whole of humanity. Further technical progress and the introduction of new environmentally friendly technologies, energy free energy of the vacuum environment, anti-gravity technology transport movements and much, much more are possible only with revolutionary upheaval all rooted erroneous initial ideas in science. Based on these circumstances, the author of the review draws attention primarily to the necessity and urgency of a serious analysis of the initial baseline physical premises of the modern theory of electromagnetism and their exceptional importance in building a really physical theory of electromagnetism and general physical theory.

INTRODUCTION

We often hear, not only from the interpreters of science, but also by scientists, often very well-known, on the severity and stage of the building of classical physics. The word "classic" has become almost synonymous with the word "complete", "inviolable", and with respect to any area of knowledge it has become a mirror finish, and hence the conservatism of some well-established at this stage and in the field of concepts. Even during the Planck believed that classical physics has nothing to do. But in this case now classical physics, apparently, all is not science, but a set of immutable laws of the system. Approximately writes about this article and author of the popular "crazy theories? Before it is far ..." [1] that "modern physics is far from complete, while classical physics is a relatively complete system of knowledge." And this kind of innocuous at first glance, the statement of completion of classical physics as a science are presented primarily the youth of today, incorrectly informing it about the actual state in classical physics and modern physics in general.

Actually, the state is such that the modern physical theory is fundamentally based on well-known concepts of classical physics, the slightest change which will inevitably lead to major changes throughout modern physics. Meanwhile, it is well known that classical physics is still very much contradictory and paradoxical. And especially a lot of unresolved contradictions and paradoxes left us a legacy from the past in classical electrodynamics. In this connection, it is surprising desire eminent specialists oblivion many well-known in the past to the contradictions and paradoxes of classical physics and attempts to ignore certain difficulties in theoretical questions of modern electrodynamics. Ought to think, but are we entitled to argue that the youth of today (which has yet to manifest itself in science, including physics, both classical and modern) no more waiting in classical physics, in this area more no uninhabited islands and islets. Meanwhile, to be objective, it is difficult even to let in such a boundless ocean of classical physics no longer remain any unexplored areas, no unexplored area. Get at least, for example, the area of classical electrodynamics.

Classical Electrodynamics - is one of the branches of classical physics, which covers an area of electric, magnetic and electromagnetic phenomena and in which "recognizes the unlimited validity of Maxwell's equations." It's no secret that even in a vast sea of classical electrodynamics, the beaten, it would seem, and the length and breadth of theoretical and experimental ways, which should cover all electromagnetic phenomena of reality, previously known and are not to know and to date many phenomena of electromagnetism, which are considered somehow strange and paradoxical and which allowed to discuss only a popular presentation [2-8], although in reality they deserve more attention. Moreover, to date the number of such "incomprehensible" and "paradoxical" phenomena of electromagnetism, which in the modern theory can explain increased significantly. Now you can count dozens of specific devices that are detected phenomena that do not fit into the framework of established ideas. A description of some of the simplest phenomena of electromagnetism meets somehow insurmountable difficulties and contradictions. In other words, in reality there are phenomena of electromagnetism, which in classical electrodynamics, assuming it is completed, there is no place. So what in this case may be a question of completeness and perfection, such as classical electrodynamics as one of the branches of classical physics? Meanwhile, similar to the same difficulties and contradictions occur in the justification of the theoretical foundations of electrodynamics. But in this case should be clearly stated that in classical electrodynamics, there is also uninhabited islands and unexplored areas, and can be, and the whole unexplored area.

---

1. "crazy theories? Before it is still far .." // Knowledge is power. - 1978. - № 11. - S. 24.

2. Technique youth. - 1968. - №12; 1969. - №8; 1974. - №12; 1974. - №1; 1982.-№3; 1984.-№1.

3. Engineering and Science. - 1983. -№ 2, 10, 11; 1984.-№1.

4. Inventor. - 1982. - №2; 1981. - № 6; 1982. -№ 10; 1984.-№2.

5. Okolotin VS This electric world // Knowledge, Science in your profession. - 1984. - №2.

6. VS Okolotin The most important task for superconductors. - M: Knowledge, 1983.

7. Feynman R., Leighton R., Sands M. The Feynman Lectures on Physics, Vol. 5. - M .: Mir, 1977. - S. 152 - 172.

8. Feynman R., Leighton R., Sands M. The Feynman Lectures on Physics, Vol. 6. - M .: Mir, 1977. - S. 15 - 30.

1. Historical background of conflict in electrodynamics

Classical Electrodynamics - Science and slim enough, at first glance, it would seem, truly complete. Well, what's new, you can say, for example, a stationary electric charge and electric field or a moving electric charge and electric and magnetic fields? Is it possible to say something new, such as Coulomb's law or the law of magnetic interaction of moving charges, not to mention the description of electrical, magnetic and electromagnetic fields known Maxwell equations. On the proposal of some authors [8] Maxwell "has put together all the laws of electricity and magnetism and created a complete and beautiful theory." And at the same time in this most "complete and beautiful theory" is somehow so many unsolved problems and serious contradictions that justifiably doubt about the full completion of the well-known classical theory of electromagnetism. Even in electrostatics remains unclear, e.g., physics relationship and charge induced by the electric field it is unclear nature of the electric field. In the simplest Coulomb's law transfer steps from one charge to another is based on, in general, is not acceptable from a physical point of view, the principle of action at a distance, the use of which is a bright and particularly vivid example of the fact that the classical concepts in electrostatics and electrodynamics based on questionable assumptions, that were introduced into physics course not because this issue was all clear. Similar conclusions can be made about themselves known equations of electrostatics in which the differential characteristic of the electric field **E (r)** at the observation point **r** is associated somehow with the density of real charges **q (R ')** , which are known to be at the observation point **R** . That is, in addition to the inconsistencies mathematical meaning of a differential equation for the point, the main essence of the equations of electrostatics also reflects a principle of action at a distance. All this forces to solve the equations of electrostatics to use all sorts of additional purely formal mathematical techniques and substituting, abstract mathematical assumptions, such as the primed coordinates, **delta** function, and others.

Even more interesting unsolved problems found in classical electrodynamics, if it, despite numerous instructions, take a more critical. First of all, as in electrostatics, electrodynamics the magnetic field in the space around the moving charges (or current elements) are determined, again, on the basis of long-range transport through currents At the same time rooted in the modern electrodynamics concepts of admissibility of non-physical principle of long-range reflect an only apparent well-being in the theory of electromagnetism. In fact, precisely because of the widespread use of the principle of action at a distance in electrodynamics found serious difficulties and contradictions, especially in the well-known mathematical methods for describing the laws of electromagnetism. And here is amazing what make this quite easy enough to Maxwell's equations for the magnetic field, for example, from the current element

$$\mathrm{rot}\mathbf{H} = \frac{1}{C}\frac{d\mathbf{E}}{dt} + \frac{4\pi}{C}\mathbf{j}_n \qquad (1)$$

determine the spatial derivative **rot H** left side of the equation and the results are compared with the right-hand side of this equation. In this case, it is found that the differential characteristic **rot H (r)** on the left side of the equation, as was to be expected, associated only with the observation point **R** , whereas the figures in the right-hand side of equation (1) current density transfer $\mathbf{j}_n(\mathbf{r}')$ obviously relates not to the same observation point **R** . In other words, if you ask notoriously known value of the magnetic field **H (r)** at the observation point **R** , then the left-hand side of the differential equation (1) it is easy to establish that a valid entry right-hand side of this equation must be of the form

$$\mathrm{rot}\mathbf{H}(\mathbf{r}) = \frac{4\pi}{C}\mathbf{j}_{\text{см}}(\mathbf{r}) + \frac{4\pi}{C}\mathbf{j}''_{\text{см}}(\mathbf{r}), \qquad (2)$$

where the first term on the right

$$\mathbf{j}_{\text{см}}(\mathbf{r}) = \frac{1}{4\pi}\frac{d\mathbf{E}(\mathbf{r})}{dt}, \qquad (3)$$

As in (1) defines a normal vector of the bias current density at the observation point **R** . Meanwhile, the second term on the right in the record (2) defines a longer transfer current density vector **j p (r ')** at the point **r '** of the current element location, as shown in (1), and the vector reverse bias current density **j " cm (R)** , again, at the observation point **R** . From (2) we see that the correct recording of the differential equation for the observation point **R** , in turn, fully reflects the physical principle and a short-range, ie. e. the magnetic field **H (r)** at the observation point **r** is determined only by the displacement currents **j see (r)** , and **j " see (r)** in the same point. Differences in the recording of the second term in equation (1) and (2) seem insignificant, but in reality these differences are precisely define significant limitations and contradictions of a certain record of equation (1). For example, if you write the correct from a mathematical point of view, write the differential equation (1) for the observation point **R** , obviously located outside the volume element of the current transfer, this record must be trivial form

$$\mathrm{rot}\mathbf{H} = \frac{1}{C}\frac{d\mathbf{E}(\mathbf{r})}{dt}, \qquad (4)$$

since the observation point **R** , we obviously have **j n (r) = 0** . On the other hand, as we have established above, the correct mathematical and physical viewpoints recording the differential equation (1) to the observation point **r** should be (2). This implies that if the current record for the item (2) is an equation, the record (4) is already simple inequality, since the left side it is not right.

More serious contradictions are found using a fixation of the equation (1) for the case of linear constant current **I n = j n S** , where **S** - cross-section of the conductor considered current. In this case, in the space outside the conductor, where we consider the interests of the magnetic field **H (R)** , there is no known current transfer **j n (r) = 0** . In addition, within the framework of known concepts is assumed that in the space around the conductor with direct current and there are no bias currents **j cm (r) = 0** , since for all space outside the conductor have **dE / dt = 0** . But in this case the right-hand side of equation (1), it would seem imperative to record

$$\mathrm{rot}\,\mathbf{H}(\mathbf{r}) \equiv 0, \qquad (5)$$

as legitimate and is offered in [9]. Formal record of the equation (5) can be considered in this case is quite correct if beforehand to believe that the space surrounding the conductor is from the physical point of view, absolutely empty, and the magnetic field **H (r)** at the observation point **r** is induced only located at a distance from the observation point currents transfer of a linear conductor. Seemingly, the principle of a short in this case is generally inapplicable, since the bias currents **j see (r)** about the linear DC conditions like these can not really exist. However, again the paradox, despite entrenched ideas about the absence of bias currents **j cm (r)** near a linear DC transfer **I n = σV** , determine the total value of the current density vector displacement **j ° cm (r)** at the observation point **r** from all elements of the

linear current, determined by the known relation (3) is easily established [21] $\Sigma J^{i}_{see}(r) = j^{\circ}_{cm}(r) \neq 0$, that at any point in the space outside the conductor with DC currents of mixing is still not equal to zero. The correctness of these statements can easily be illustrated graphically, assuming the correct definition introduced by Maxwell displacement current density vector $j_{cm}(R)$ (3) (Fig. 1).

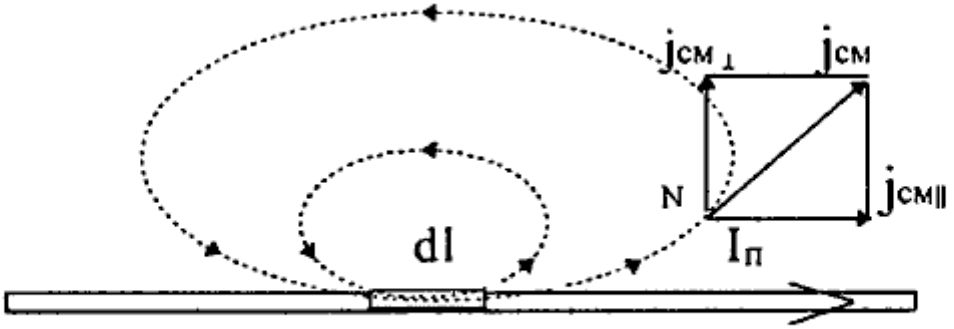


Рис. 1

Fig.1 shows that any element of D **L** linear DC $I_n = \sigma V$ bias currents, defined by relation (3), starting at this current element and end it the same. If you select two elements linear current D L_1 D and L_2, which are at the same distance from the observation point **N** (Fig. 2), the displacement current density vector j_{cm-1} from the element D L_1 at the observation point **N** will be sent from the element D L_1 whereas the current density vector displacement j_{cm2} from the element D L_2 will be sent to the element D L_2.

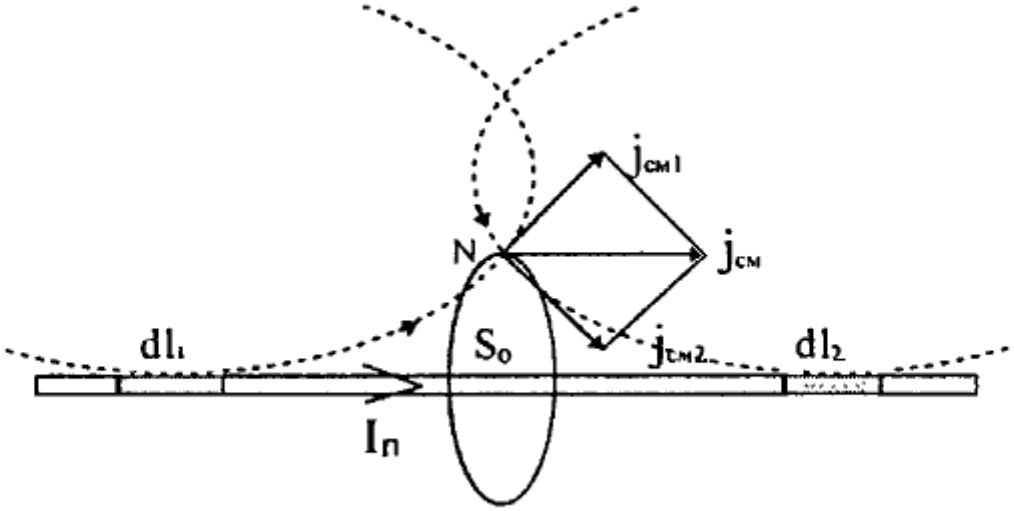


Рис. 2

The resulting vector as the displacement current density $j_{cm}(N)$ at the observation point **N** is not equal to zero, and directed towards the transport current I_n. It is easy to see that a similar situation will occur for any other symmetric pairs of the same elements of the current. Which immediately establish that the integral value of the current confusion in the observation point **N** of all elements of the current pair will have deliberately non-zero value. Consequently, it is possible already to conclude with reasonable certainty that the mixing currents $j_{see}(r)$ of all pairs of elements I_n D **L** linear DC is still not zero, the correct recording of the differential equation (5) to the observation point **R**, which reflects the physical principle of a short receives a finished look

$$\text{rot } \mathbf{H}(\mathbf{r}) = \frac{4\pi}{C}\, \mathbf{j}^{\circ}_{\text{см}}(\mathbf{r}). \qquad (6)$$

Thus, if it is determined for the vector $\mathbf{j}^{\circ}_{\text{см}}(\mathbf{r})$ at the observation point **R** , it greatly simplifies the solution of the equation. To solve the equation (6) is sufficient to determine the integrals over the surface $\mathbf{S}_0$ (see. Fig. 2) from the right and left sides of the equation, thereby determining the total flux tube bias current section $\mathbf{S}_0$, the surface of which is sought on the basis of short-range magnetic field of interest to us **H (R)** . When comparing significantly different records right-hand sides of equations (5) and (6) the question naturally arises: **what is the physical point of view of the original fallacy ingrained notions about the absence of displacement currents in the space around the linear constant current? Studies of this issue indicate that the reason for this lies in the limitations made even at the time Maxwell assumptions about the applicability of the theorem Gauss not only for stationary electric charges, but also for moving. As a result of this arbitrary assumptions dynamic state moving electric charges linear current simply replaced their usual static state, ie, artificially ignored factor of finding the system in other known physical conditions.** Thus, if we want to reflect established in the electrodynamics of the principles of long-range, the magnetic fields **H (r)** at the observation point **r** outside the conductor currents are only initiated the transfer of the conductor, the Maxwell equation (1) in this case should be written in the form

$$\text{rot } \mathbf{H}(\mathbf{r}) = \frac{4\pi}{C}\, \mathbf{j}_n(\mathbf{r}'), \qquad (7)$$

However, this record does not match the mathematical nature of the differential equation for the observation point **r** and generally is inequality. If observe the mathematical rigor of the differential equation for the observation point **R** , then the Maxwell equations should be set to record above equation (6), but this is not rooted in the electrodynamics of ideas about the magnetic field **H (r)** only transport currents $\mathbf{j}_n(\mathbf{r}') \neq \mathbf{0}$. These insoluble contradictions can be found for any other case of an arbitrary non-closed or current. Perhaps it was these circumstances due to the fact that in the scientific literature universally adopted formal record of Maxwell's equations in general without linking them to specific coordinates of the observation point in the form

$$\text{rot } \mathbf{H} = \frac{4\pi}{C}\, \mathbf{j}_n, \qquad (8)$$
$$\text{div } \mathbf{H} = 0.$$

that gives them an apparent rigor and consistency. **It is similar to artificial devices and gives the impression of completeness "beautiful building" electromagnetism.** But even in this form (8), Maxwell's equations are not without their paradoxical essence. It can be shown that for the simplest case of a single moving charge is found a number of other equally serious contradictions [10].

Especially a lot of different problems arise when trying to review this uncharted area of modern electrodynamics as displacement currents. On the one hand, according to modern concepts, the bias currents are a physical reality, because without them it is impossible to understand the workings of a simple capacitor, on the other hand, the bias currents - a mathematical formality with which it is possible to make a symmetrical Maxwell equations [11, 12]. On the one hand, the magnetic properties of the bias currents are accepted as equivalent magnetic properties of the current transfer, as "these

currents are included in the same way to the right side of Maxwell's equations" [13]. On the other hand, the magnetic field moving charges somehow determined only by one current transfer as bias currents while absent. However, it is not difficult to understand the reason for this, if we turn to the known mathematical methods for solving Maxwell's equations. The reason for this is that so far in electrodynamics there are no suitable direct methods for solving Maxwell's equations directly through the bias currents. As for the known solutions of the Poisson equation formalism, which reduces the system of Maxwell's equations, this formalism is generally inapplicable to the bias currents. If in the solution of Maxwell's equations for the case, for example, a single moving charge (using a known formalism primed coordinates and δ-function) still try to take into account both the displacement currents, and transfer current, the magnetic field of the moving charge is obtained by doubling the value of [10]. This suggests that the magnetic field induced by the moving charge or a current charge transfer (on the principle of action at a distance), assuming the absence of any physical entity in bias currents, and hence the lack of and need for them at all, or some bias currents (on the basis of short-range) under the assumption that certain ideas about current transfer moving charge any formal substantive and should be completely eliminated from the equations. Studies of this issue indicate [10] that both the mathematical and physical points of view, preference should be given only bias currents. But the most surprising in this case is that when trying to find a direct solution of Maxwell's equations through the bias currents is determined that the assumption of a moving charge in another species previously unknown to science in the magnetic field, and so on. D.

As can be seen from the discussion and theoretical issues of classical electrodynamics, there are many unresolved issues. **In the process of searching for a long period out of the difficulties in electrodynamics attempts basically no change in the source of erroneous ideas, and crawled difficulties encountered by the complexity used in formal electrodynamics mathematical methods. At the same time, in order to avoid the difficulties and contradictions in electrodynamics, use all possible means of mathematical formalism, instead of the correct way to analyze inherent in the electrodynamics of the premises and presentation.** As a result of this approach in solving practical problems in classical electrodynamics commonly used purely formal methods assumptions, constraints, so-called "additional conditions", "normalization", "calibration", primed coordinates, δ-function formalism depersonalization and other attributes of the mathematical formalism. In mathematics, it is well known that any gaps physical theories (inaccurate and erroneous presuppositions) always have to "patch the patch" mathematical formalism and modern mathematical methods of electrodynamics are fairly clear example of this, as the "patched" theory still remains controversial, and no less paradoxical. Question arises, what is the main reason for this unsatisfactory situation in modern electrodynamics? Are all these contradictions revealed only a consequence of some one reason or reasons for such a little? To answer this question we must turn to history and to recall the obvious fact that his theory of electromagnetism Maxwell built primarily based on the assumption of the reality of the existence of a material carrier medium fields. However, over time, due to the refusal in physics from any medium model, the physical nature of Maxwell's equations were gradually emasculated. Moreover, Maxwell was delivered to reproach [8], that he, you know, did not foresee a large community of them derived equations that "now we can better understand **(Maxwell himself did not understand ?! - GN),** which is the case in the equations themselves, not in the model, with which they were removed ... If we set aside all the scaffolding used by the Maxwell equations to obtain, we come to the conclusion that beautiful building, created by Maxwell, holds in itself. " Simply amazing! However, there may also arise doubts whether it holds a "beautiful building" really is in itself?

Thus, the model of the environment is essential to Maxwell was to bring his famous equations of electrodynamics in which, for example, the displacement currents have a well-defined physical entity. But as soon as the equations were obtained them from the offspring of these equations - their original model - decided (but only after Maxwell!) Refuse completely, leaving only the abstract mathematical

essence of equations themselves. No need to be a visionary to realize that as soon as Maxwell's equations have been separated from their original model, as soon as they have come to represent an independent abstract mathematical entity with the same ever since Maxwell's equations and lost its physical content. From this very moment the Maxwell equations have lost almost any possibility of his additions, changes and improvements. There was only one possibility of a purely abstract formal mathematical perfection, which was carried out in reality, those who continued to maintain "a beautiful building." It is not hard to understand now also what caused the fact that Maxwell's equations in physics from the time of their creation remained almost intact in its unfinished form. That there was no reason to rebuke such unfounded conclusions show immediately on concrete examples, in what appears incomplete built by Maxwell "complete beautiful building" electrodynamics, although Maxwell himself [14] had a different view and indicate the presence of the principal difficulties in the applicability of his proposed equations electrodynamics, for example, a non-closed electrical currents, the individual elements of current, etc.

First of all, because of the explicit relativistic formalism known of the properties of real space, which relies completely empty abstracted some mathematical space, so far in electrodynamics never found the actual physical nature of bias currents and determine their role in the reflection of a short-range physical principle. For this reason, in electrodynamics is not established the existence of a direct functional relationship between the displacement currents and induced their magnetic fields. As a result of this, we have that knowledge representations within known bias current distribution in this space, for example, is the current conductor does not allow, however, to establish the corresponding values of the magnetic fields in the same space. In addition, for the same reasons account for the differential equations of electrodynamics of points in space outside the conductor, from a mathematical point of view, does not correspond to mathematical rigor of the differential equation for the point that, in turn, eliminates the possibility to understand the real essence of the physical phenomenon of magnetic induction. To date, no known overcome in the time of Maxwell's difficulties and contradictions in solving the system of equations of electrodynamics as applied to individual elements of the current and open-currents. Challenges and controversies as these lie in the fact that in the case of segments of the current and one open currents are not equal to zero spatial derivative ROT = **A H** vector potential **A** , in general, no longer completely defines it. Revealed the existence of yet another non-zero spatial derivative div $\mathbf{A} \neq \mathbf{0}$ the same vector potential **A** . As a result, it is found that the proposed entry Maxwell equations electrodynamics only one spatial derivative ROT vector potential $\mathbf{A} \neq \mathbf{0}$ (m. e. for one type of magnetic field **H** = ROT **A**), while ignoring other explicit div $\mathbf{A} \neq \mathbf{0}$ (m. e. while ignoring other types of magnetic field **H** = **-** div **A**), is simply incomplete, and the correct solution of the equations in this recording is impossible. Attempts to circumvent these difficulties artificial transitions from closed to open currents and arbitrary imposition on the vector potential **A** so-called "additional conditions" div $\mathbf{A} = \mathbf{0}$, with the help of other formal mathematical methods allow us to find, once again, the formal solutions to Maxwell's equations. However, the substitution thus found solutions to the original equation shows that the original Maxwell's equations are already simple inequalities. Moreover, in some cases, found the essence of formal and explicit limitations and themselves Maxwell's equations in differential and integral form. For example, when describing the trivial phenomenon of electromagnetic induction when using conventional transformer Maxwell's equations in their differential form are generally applicable, as the vortex electric field **E (r)** induction in the space around the transformer induced regardless of the presence in the same space of time-varying magnetic fields **H (R)** , m. e., subject $\partial \mathbf{H} / \partial \mathbf{T} = \mathbf{0}$. In other words, for every point in space **r** about transformer for differential equations, would seem to be a valid entry

$$\mathbf{rotE} = -\frac{1}{C}\frac{\partial \mathbf{H(r)}}{\partial t} = 0, \tag{9}$$

$$\mathbf{div\ E(r)} = 0 \tag{10}$$

and induction of vortex electric field **E** must be absent. Found a formal nature and the limitations of a clear and well-known representations of the vector magnetic field **H** = ROT **A** and a "magnetic flux" of this field through the surface of the circuit. It is known, for example, that the solution of specific practical problems the basic equation of electromagnetic induction in the integral form

$$\varepsilon' = \oint_{1234} \mathbf{Edl} = \frac{1}{C}\frac{\partial}{\partial t}\int_S \mathbf{HdS} = \varepsilon_1' + \varepsilon_2' + \varepsilon_3' + \varepsilon_4' \tag{11}$$

is in satisfactory agreement with the experimental observations only in determining the resultant EMF in a closed loop, while the predicted distribution of this equation vortex electric field **E** along the induction of individual aspects of this circuit is in stark contrast with the results of experimental observations [15]. Moreover, because of the formalities rooted in electrodynamics representations about a "magnetic flux" is found and fundamental limitations of known concepts of induction of electric current in the circuit time-varying "flux". If a closed loop of wire is threaded a time-varying "flux" ∂ **cp** / ∂ **T** $\neq$ **0** , for example by uniformly and rectilinearly moving around the contour of the electric charge (or extended bunch of charges), then, in spite of the seemingly obvious requirement of dependence (11), the resulting voltage in this circuit is equal to zero **ε = 0** [16,73], t. e. to the known dependence (11) establish the inequality of the form

$$-\frac{1}{C}\frac{\partial \Phi}{\partial t} = -\frac{1}{C}\frac{\partial}{\partial}\int \mathbf{Hdl} \neq \oint \mathbf{Edl} = \varepsilon = 0. \tag{12}$$

In turn, the non-restriction (12) in other cases leads to all sorts of difficulties and unreasonable to infinity [15].

However, on the other hand, in the electrodynamics, in general, also other known methods for determining the vortex induction electric field **E** within the framework of a different formalism - field vector potential **A** in the form of equation

$$\mathbf{E(r)} = -\frac{1}{C}\frac{\partial \mathbf{A(r)}}{\partial t}. \tag{13}$$

And the surprising thing is that with the help of this equation, without the use of a formal representation of the "magnetic field" and "magnetic flux", the actual distribution of the vortex electric induction field **E** along the sides of the closed loop is easily installed from the simple relationship

$$\varepsilon = \oint_{1234} \mathbf{E}d\mathbf{l} = -\frac{\partial}{\partial t}\oint \mathbf{A}d\mathbf{l} = \varepsilon_1 + \varepsilon_2 \ . \qquad (14)$$

In turn, as is evident from (13), in the case of a uniformly and rectilinearly moving charge is zero partial derivative $\partial \mathbf{A} / \partial \mathbf{T}$, as a result, and because of what is just and no induction current in accommodation that is close to the moving charge closed loop . In addition, the formalism of the field vector potential **A** in the record (13) is just well suited to describe the phenomenon of electromagnetic induction current in the conductors is the transformer core, because the core is provided $\partial \mathbf{H} / \partial \mathbf{T} = \mathbf{0}$ just realized the condition $\partial \mathbf{A} / \partial \mathbf{t} \neq \mathbf{0}$. Therefore, you can have with sufficient certainty that the formalism of field vector potential **A** in practical terms to a much greater extent with the experimental observations than entered in the electrodynamics of Maxwell formalism "magnetic field" and "magnetic flux". However, again the paradox, the very definition of the concept of the vector potential in the modern electrodynamics all is not well.

It is known that classical physics does not give a clear answer to the question what is, from a physical point of view, the vector potential **A** magnetic field and what is its real essence. So far, it is unclear, for example, whether a field is the vector potential **A** real physical field or is only a convenient mathematical tool for describing the magnetic field **H** ? Staging such an issue is caused by another known strange circumstances, if non-zero value of the magnetic field **H** in this space always corresponds to a non-zero value of the vector potential **A** at all points in the same space, the non-zero value of the vector potential **A** in this space is not always corresponds to a non-zero value of the magnetic field **H** at all points in this space. However, we know that the reality of the existence of the magnetic field **H** in this space can always be easily installed to detect the magnetic interaction with the field of moving electric charges therein. Moreover, the interaction of moving charges with the magnetic field **H** is determined by the well-known in physics dependence, written in the form of the Lorentz formula. The difficulty in determining the actual physical nature of the field vector potential **A** are manifested primarily in the fact that a similar dependence for the interaction of moving charges with the field of the vector potential **A** in physics is unknown. Absent in physics and any other conventional means of recording field vector potential **A** . If we take into account that used in classical electrodynamics mathematical formalism allows, in general, a certain arbitrariness in the choice of the vector potential function $\mathbf{A}' = (\mathbf{A} + \nabla \mathbf{ip})$, sets the appropriate field of the vector potential **A** magnetic field **H** only up to a certain gradient scalar function, the question of the physical nature of the field vector potential **A** general meaningless. In other words, this means that the same appears in experiments actual magnetic field **H** may correspond to an infinite set of potential field vector $\mathbf{A}' = (\mathbf{A} + \nabla \mathbf{ip})$, gradient as the rotor is always zero. It should be noted that the same as in the choice of the vector potential **A** is allowed, in general, and in quantum mechanics, which further emphasizes the formal non-physical nature of the vector potential. As in classical electrodynamics and quantum mechanics ingrained notion that physical significance can only have ROT **A** vector potential **A** , while most vector potential **A** is given the auxiliary and secondary role, and the existence of any physical significance in other non-zero spatial derivative div **A** of the same vector potential **A** , within the framework of the well-known formalism generally excluded.

It is generally accepted that if you know the very "physical" magnetic field **H** , it seems to be no need to seek the help of "formal" vector potential **A** . However, the mere fact that the Schroedinger wave equation appears only "formal" vector potential **A** , was obvious from the moment of writing this equation. The story is interesting because at the time many unsuccessful attempts were made to replace the "formal" vector potential **A** in the equation of quantum mechanics "physical" magnetic field **H** . And all who have tried to make such a change, to make sure that it is simply impossible to do. But in this

case it is possible, it would seem to conclude that the wave function, for example, any of the moving charge in the field of the vector potential **A** should reflect the existence of a quite sensible action moving charge with this field and the magnitude of this interaction should be defined clearly by the change in the vector potential **A** wave function. Although the theory of this effect has been known, in general, since the emergence of quantum concepts in physics, the specific nature of the interaction of a moving charge with the field vector potential remained unclear. In 1956, Aharonov and Bohm was first proposed method of experimental verification of the effect [8]. In an experiment intended to detect the change in phase of the wave function in the absence of the moving charge and available space in the test field vector potential **A** , but at the same time in the complete absence of this space, the magnetic field **H** . Soon these experiments confirmed the existence of really effect Aharonov-Bohm effect. And as to be expected, the positive results of the experiments corresponded to only single digits of the vector potential **A** is compared with the same parameters unambiguous elemental power. A more accurate precision experiments also confirm the existence of a clear effect Aharonov-Bohm effect, was conducted by a team of Japanese physicists [17], which was used in the experiment miniature toroidal magnetic magnetized in the space around which almost completely absent from the usual magnetic field.

Thus, on the one hand, the reality of the field vector potential **A** and the uniqueness of its magnitude can be considered like experimentally proven. Can be considered experimentally proven also that there is an unambiguous and also the interaction of the vector potential with a moving electric charge in it, although the exact physics of this interaction remains unknown. However, on the other hand, it remains unclear how then be entrenched in the electrodynamics of arbitrariness in the choice of the vector potential, commonly used in formal methods for solving Maxwell's equations? How to deal with the very formalism "magnetic field"? Remain unclear, and many other issues related to the concept of the essence of the vector potential field, the answer to that in modern electrodynamics, unfortunately, can not be found. Evidence of this are the numerous publications in the press [8,17-20].

It can be shown [10, 15, 21, 22], which is known entrenched formal presentation of the "magnetic field" and "magnetic flux" in a matter of "finished a beautiful building" modern electrodynamics leads also to a number of other equally serious difficulties and contradictions. And especially a lot of contradictions and paradoxes in electrodynamics is simply due to the restrictions apply to the modern theory of the formalism of the vector magnetic field **H** = ROT **A** , with blatant disregard the existence of yet another type of magnetic field **H** $\parallel$ -div = **A** . These contradictions and paradoxes in modern electrodynamics, as will be shown below, as already found in numerous experimental observations and theoretical foundations of the modern theory of electromagnetism. However, from the above examples of the limitations and formally known concepts of "magnetic field" and "magnetic flux" is nevertheless still unclear, what is the main underlying cause inconsistency built by Maxwell electrodynamics? For a clear answer to this question should be re-look at the history and, in particular, by the fact "primitive" with the modern point of views that have been known since the dawn of the initial concepts of the laws of electromagnetism. For example, it should be noted that even in his time Ampere, Grossman, Gauss, Lenz, Neumann, Weber, Riemann et al. Were on the point of view that, without resorting to the concept of "magnetic field", any magnetic interactions can be reduced to the usual interactions current elements

$$\mathbf{dF} = \frac{I_1 I_2}{C^2 r^3}\left[\mathbf{dl}_1 \times \left[\mathbf{dl}_2 \times \mathbf{r}\right]\right] \qquad (15)$$

or moving charges $\mathbf{e}_1$ and $\mathbf{e}_2$

$$\mathbf{dF} = \frac{e_1 e_2}{C^2 r^3}\left[\mathbf{V}_1 \times \left[\mathbf{V}_2 \times \mathbf{r}\right]\right], \qquad (16)$$

where $\mathbf{I}_1 D \mathbf{L}_1$ - current element moving charge $\mathbf{e}_{one}$ who is experiencing the action from the current element $\mathbf{I}_2 D \mathbf{L}_2$ moving charge $\mathbf{e}_2$.

That is, in the real case, the description of "magnetic" properties of the currents and any "magnetic" interactions, it turns out, can be accomplished by not resorting to the submission of a formal "magnetic field" and thus avoid the associated notion of serious contradictions. However, unfortunately, in electrodynamics prevailed then the point of view of Faraday and Maxwell, that electric and "magnetic" field are separate physical entities, although interconnected. In the current historical situation when the data error from the physical point of view, the assumption is predetermined the whole further course of electrodynamics clearly laid down in its insoluble contradictions and paradoxes. To verify the obvious constraints of the assumptions of construction of electrodynamics proposed by Faraday and Maxwell, show a specific example, what serious distortions of the physical nature of the phenomena of electromagnetism they lead.

As part of the presentation of the electric **E** and magnetic **H** fields that are consistent with modern ideas, for the full force of interaction, in the particular case, parallel to the moving charges $\mathbf{e}_1$ and $\mathbf{e}_2$ at $\mathbf{V}_1 = \mathbf{V}_2 = \mathbf{V}$ and $(\mathbf{V}\,\mathbf{R}) = 0$ can be written

$$\mathbf{F}_m = \mathbf{E}_1 e_2 - \frac{e_2}{C}[\mathbf{V}_2 \times \mathbf{H}_1], \tag{17}$$

where the first term on the right determines the continued strength of the Coulomb interaction of the charges $\mathbf{e}_1$ and $\mathbf{e}_2$, which does not depend on the state of rest or motion of the charges, while the second term on the right determines the speed-dependent strength of the magnetic interaction of the charges $\mathbf{e}_1$ and $\mathbf{e}_2$.

Within the same view Ampere (15), (16), without resorting to the concept of "magnetic field", for the same case have

$$\mathbf{F}_A = \mathbf{E}_1 e_2 - \frac{e_1 e_2}{C^2 r^3}[\mathbf{V}_1 \times [\mathbf{V}_2 \times \mathbf{r}]] = \mathbf{E}_1 e_2 - \mathbf{E}_1 e_2\left(\frac{V^2}{C^2}\right) = \mathbf{E}_1 e_2\left(1 - \frac{V^2}{C^2}\right), \tag{18}$$

where the term on the right defines a slightly modified law of Coulomb interaction of moving charges $\mathbf{e}_1$ and $\mathbf{e}_2$. Although his mind given record (17) and (18) are substantially different, quantitatively they are completely equivalent. However, from the analysis of the last recording (18) the conclusion that the physical nature of "magnetic" interaction of moving in real space of the physical vacuum charges $\mathbf{e}_1$ and $\mathbf{e}_2$ is that the rest of the charges in the physical vacuum ($\mathbf{V}_1 = \mathbf{V}_2 = 0$) the interaction between them is due to the usual static electric fields $\mathbf{E}_1$ and $\mathbf{E}_2$ of the Coulomb type

$$\mathbf{F}_K = \mathbf{E}_1 e_2 = -\mathbf{E}_2 e_1, \tag{19}$$

whereas the motion of charges in the physical vacuum unequal to zero speed $\mathbf{V}_1 = \mathbf{V}_2 = \mathbf{V}$ Coulomb static electric fields $\mathbf{E}_1$ and $\mathbf{E}_2$ of these charges that would naturally be expected to undergo a certain deformation.

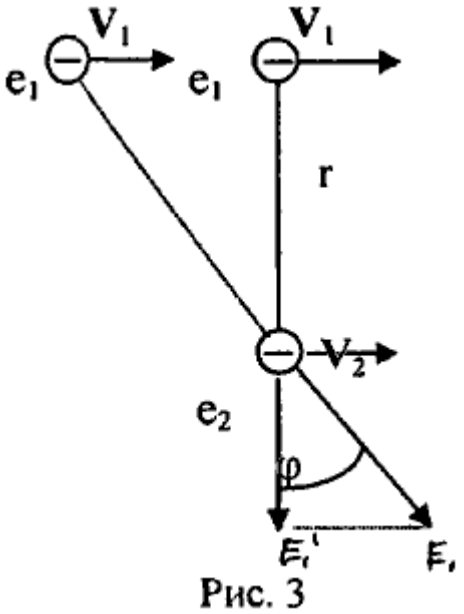


Рис. 3

At the same time, taking into account the generally known physical concepts and taking into account the real conditions of the finite velocity of propagation of electrical disturbances in the physical vacuum, and the existence of trivial retarded potentials, for a deformed electric field **E** ' $_1$, for example, a moving charge **e** $_1$ (see. Fig. 3) at the point where the charge **e** $_2$ is easily established [23-26]

$$\mathbf{E}_1' = \mathbf{E}_1 \cos\varphi \ , \tag{20}$$

where cp - aberration angle displacement vector of the electric field **E** $_1$ due to the lag effect of the field is determined from the known relation

$$\sin\varphi = \frac{V}{C} . \tag{21}$$

Taking into account that the electric field **E** $_2$ of the second moving charge **e** $_2$ is also deformed by the aberration angle φ and is defined similar to (20) dependence

$$\mathbf{E}_2' = \mathbf{E}_2 \cos\varphi \ , \tag{22}$$

for the resultant value e ' $_{two}$ physically moving vacuum electric charge **e** $_2$ in turn is

$$\mathbf{e}_2' = \mathbf{e}_2 \cos\varphi . \tag{23}$$

As a result, to address the real physical conditions (20), (23), taking place in the interaction of moving charges in the physical vacuum **e** $_1$ and **e** $_2$, for the electric force **F** ' interaction in the dynamics of these charges directly set

$$\mathbf{F}' = \mathbf{E}_1' \mathbf{e}_2' = \mathbf{E}_1' \mathbf{e}_2 \cos\varphi = \mathbf{E}_1 \mathbf{e}_2 (1 - \sin^2\varphi) = \mathbf{E}_1 \mathbf{e}_2 (1 - \frac{V^2}{C^2}) , \tag{24}$$

that is completely equivalent to (18).

Thus, based on the consideration of real physical conditions that the speed of propagation of electrical disturbances in the physical vacuum is finite and the charge movement in the physical vacuum leads to the obvious, from the physical point of view, the effects of delay and distortion of the electric field **E** , the Coulomb interaction force $\mathbf{F}_{to}$ (19), between the charges in the state of their motion in a physical vacuum should not remain constant, which in reality, and establishes a relationship (24). However, if we start from a known abstract and apparently erroneous assumptions that the real space completely empty, and the speed of propagation of electrical disturbances in its infinite and electric fields $\mathbf{E}_1$ and $\mathbf{E}_2$ moving charges are not subject to any deformation, then we will be forced to admit that the Coulomb interaction of electric between moving charges should remain unchanged, as if all charges are not subject to any movements. Explicit inaccuracy of such findings is largely due was, as noted already above, a priori assumptions of Maxwell that the Gauss theorem for stationary electric charges applicable for moving electric charges. To explain the observed results as real (18), (24), in turn, we will be forced to admit the existence of moving charges about some compensation "magnetic fields", the interaction that provides the necessary "magnetic" correction $\Delta\mathbf{F}_m$ (the second term on the right side (17)) to the immutable Coulomb interaction, ie,

$$\mathbf{E} = \mathbf{E}_1 e_2 - \Delta\mathbf{F}_м , \qquad (25)$$

whereby precisely the equivalence of the expressions (25) and (24). From the above it is clear that the need for a formal representation in the electrodynamics of the "magnetic field" is due only clearly erroneous and non-physical representations as a real space and the speed of propagation of electrical disturbances in it, and about the actual electric fields resting and moving charges. Of course, the proponents of ideas rooted in electrodynamics can argue here that in modern electrodynamics, they say, is treated as a finite speed of light, and the retarded potentials. This authority may refer to numerous textbooks. However, a striking contradiction of modern electrodynamics lies precisely in the fact that the determination of the electric field **E** of a moving charge, as such, is its connection with other fields and charges in the general case can be taken into account and the finiteness of the speed of light, and retarded potentials. Meanwhile, in the interaction of the electric field **E** of the same moving charge with other electrical fields or charges need to consider finite speed of light and retarded potentials relies somehow unnecessary and a formula electrical interaction of moving charges have substituted conventional static Coulomb electric field and allegedly appearing " magnetic fields. " It was such arbitrary restrictions imposed just necessitate the introduction of a formula of interaction of an additional term "magnetic" charge interaction. Partially noted that the use of a formal representation of the "magnetic field" and "magnetic flux" in modern electrodynamics causes the appearance of certain difficulties and contradictions. Now it turns out that these difficulties and contradictions were deliberately built into its base is clearly unphysical initial assumptions about the immutability of the static electric field at rest and movement of electric charge. However, in reality, the negative consequences of these assumptions proved to be more significant, as in Maxwell's electrodynamics was "permanently" lost opportunity to establish the existence of another type of magnetic field and another longitudinal "magnetic" force. You can, for example, is now shown [25, 26] that if we consider again the trivial from the physical point of view, the delay effects for electric fields from moving in a straight line has charge $\mathbf{e}_1$ and $\mathbf{e}_2$, then the dynamic electrical force **F '** interaction between them will once again be the dependence (24), whereas the non-physical Maxwell (17) and limited Ampere (18) approaches for the same case give $\mathbf{F}_M = \mathbf{F}_A \equiv \mathbf{F}_K$, t. e. the Coulomb interaction constant. In other words, under the well-known concepts in electrodynamics, the magnetic interaction between two moving in a straight line charges $\mathbf{e}_1$ and $\mathbf{e}_2$ generally excluded. Although, again a paradox **in electrodynamics known integral dependence for magnetic fields interacting charges, from which it**

follows immediately the possibility of magnetic interaction of moving in a straight line of electric charges.

Similar evidence can be cited within the formalism of the vector potential field, taking into account the non-zero value of the interaction energy of a moving charge with the vector potential of another [13]. The possible existence of longitudinal forces between moving in a straight line electric charges is considered in the framework of new approaches in electrodynamics [27-32].

Presented here is already quite enough to make certain and unequivocal conclusion that inherent in Maxwell's electrodynamics original idea of a vector "magnetic field" $\mathbf{H}_{\perp}$ = ROT **A** , with blatant disregard of another scalar "magnetic field" $\mathbf{H}_{\parallel}$ = - div **A** , not Only obviously wrong, but obviously limited.

Of course, one can hardly deny that erroneous and limited understanding of the "magnetic field" in Maxwell's electrodynamics, for more than a century of their rule, not played a positive role in the overall scientific progress. However, what would be the results of this progress, though at one time prevailed a more realistic view of the dynamic interaction of electrical, now it is simply impossible to imagine. Already the above analysis of the reasons for the paradoxical nature of modern electrodynamics enough to realize that the path traversed in electrodynamics largely have to go through again, but of course have new theoretical and experimental ways, the beginning of which was predicted by physicists still more than a century ago. Now we can only hope that such a "rich" accumulated experience of walking on the electrodynamics wrong, to a certain extent, the theoretical and experimental ways will finally determine the right direction in the development of objective view of our laws of static and dynamic electricity.

A state of rest and movement of electric charge in respect of such defining factor in our environment, what is a massive gravitating body of the Earth, in turn, determines the state and the associated physical vacuum [23, 24, 33-38], should find enough fully reflected in the new approach, describe the laws of electromagnetism. Need to take account of asymmetric physical properties of the real near-Earth space supported by the results of analysis of optical and electrodynamic phenomena observed on the surface of the Earth.

---

8. Feynman R., Leighton R., Sands M. The Feynman Lectures on Physics, Vol. 6. - M .: Mir, 1977. - S. 15 - 30.

9. Neiman LR, KS Demirchian Theory of Electrical Engineering, Vol.2. - L .: Energy, 1975. - S. 270 - 276.

10. Nikolaev GV 1. Displacement currents and radial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep VINITI, reg. № 3487-78.

11. Purcell E. Electricity and Magnetism. - M .: Nauka, 1971. - 265 pp.

12. Levich, VG Course of Theoretical Physics, Vol 1 - M .: Nauka, 1969.-S. 32.45, 104-110.

13. IE Tamm Fundamentals of the theory of electricity. - M .: Nauka, 1976. - S. 78 - 83,230,233,370,400.

14. J. Maxwell. Selected works on the theory of the electromagnetic field. - M .: Gostekhizdat, 1954.

15. Nikolaev GV IV. Justification of the reality of the axial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 528-79.

16. Nikolaev GV VIII. On the nature of the vortex electric field gradient moving charge. - Dep. VINITI, reg. № 5812-85.

17. Observation of the Aharonov-Bohm // Nature. - 1983. - № 7. - S. 106.

18. M. Danos effect Aharonov - Bohm quantum mechanics electrical transformer // Physics abroad. Ser. B. - M .: Mir, 1984. - S. 100-105.

19. darling BN On the theory of the Aharonov-Bohm effect. - Dep. VINITI, reg. № 2931-80.

20. Solunin AM On the electrodynamics and the effects of the vector potential. - Dep. VINITI, reg. № 5416-85.

21. Nikolaev GV II currents bias and radial magnetic field of a linear current / Ed. Zh."Proceedings of the universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 3488-78.

22. Nikolaev GV V. The system of equations for the axial (scalar) and radial (vector) magnetic fields of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2664-80.

23. Nikolaev GV The laws of mechanics and electrodynamics near-Earth space. Vol. 1. - S. 541 (R & D. - State. Register. № 74007254, B324555otU. 1974.).

24. Nikolaev GV The limits of applicability of classical and relativistic electrodynamics in near-Earth space. Vol. 2. - P. 164 (R & D. - State. Register. № 74007254, B340882 from X. 1974).

25.Nikolaev GV, Okulov BV On the inertial properties of the electrons / Ed. Zh."Math. Universities. Physics." - Tomsk, 1978. - Dep. VINITI, reg. № 4399-77.

26. Nikolaev GV XI.Electrodynamic phenomena in the motion of the charge in the physical vacuum. - Provision for deposit.

27. Ampere AM Electrodynamics. - Moscow: USSR Academy of Sciences, 1954.

28. Alechinsky VG On the question of the impact of the current formula electrodynamic elements // Math. universities. Electromechanics. - 1980. - №4.- S. 431 -434.

29. Sinelnikov EM, Sinel'nikov DE Ponderomotive interaction of two elementary bodies in a quasi-stationary magnetic field // Math. universities. Electromechanics. - 1976. -№1. - S. 13-18.

30. Sinelnikov DE, Sinel'nikov EM Formula for determining the force interaction current elements // Math. universities. Electromechanics. - 1978. - №3. - S. 227 - 235.

31. Gade VV Conformal version of Maxwell's equations and the Lorentz. - Novosibirsk, 1985 / Preprint, USSR Academy of number 588.

32. Solunin AM K-Electrodynamics // Interuniversity collection of ISU, Ivanovo, 1982. - Dep. VINITI, reg. № 3908-82.

33. Nikolaev GV On the laws of electrodynamics and optics in rotating frames of reference relative to the Earth / Red. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 2911-74.

34. GV Nikolaev, Okulov BV On the exponential justify the principle of relativity / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 3064-74.

35. Nikolaev GV The paradox of Feynman and asymmetry laboratory and moving reference frames / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 1937-75.

36. Nikolaev GV Hall effect and the asymmetry of the laboratory and the moving reference frames / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 2507-75.

37. Nikolaev GV On the Limitations of classical and relativistic electrodynamics in the conditions on the surface of the Earth / Red. Zh."Math. Universities. Physics." - Tomsk, 1976. - Dep. in VNITI, reg. № 3277-75.

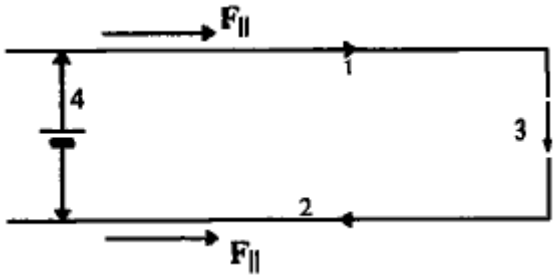
38. Nikolaev GV On checking the fundamental relations in the satellite / Ed. Zh."Math. Universities. Physics." - Tomsk, 1976. - Dep. VINITI, reg. № 3429-75.

---

2. Experimental paradoxes of electrodynamics

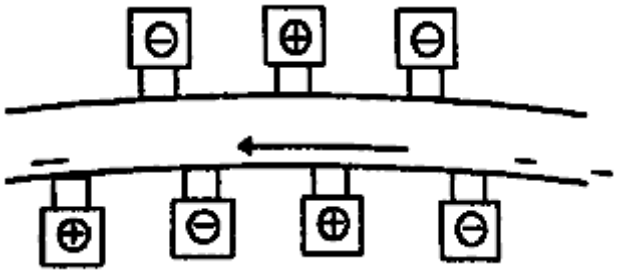
Any theory, no matter how perfect it was, never rule out the possibility of its further improvement. The value of a physical theory is primarily determined by the area of its practical applicability. With regard to the well-known theory of electromagnetism, in the framework of modern concepts in electrodynamics, the question of the practical applicability of the general theory, of course, there is no doubt. However, despite the seemingly endless field of practical applicability of the modern theory of electromagnetism and the tremendous achievements of science and technology in these areas to date have accumulated a significant amount of electrodynamics phenomena of electromagnetism, which modern theory can not give a consistent and correct explanation. That is, in the long process of practical development of the laws of electromagnetism, which were identified in the well-known theory, humanity is faced with the phenomena of electromagnetism, which was obviously beyond the scope of the modern theory. The appearance of such paradoxical, in terms of the existing theory, the phenomena of electromagnetism is completely natural and just proves, on the one hand, the limitations of the existing theory of electromagnetism, and the other - the need for further improvement. Therefore, to understand the reasons for the paradoxical nature of modern electrodynamics should appeal primarily to the analysis of those being unjustly neglected paradoxical phenomena of electromagnetism that were known in the days of Ampere and found now in many experimental observations. The number of such complementary observations have accumulated enough so that you can make them quite definite conclusions. In addition to the known observations of "strange" magnetic interactions author posed a series of special experiments that reveal the actual physical nature of the so-called "paradoxical" phenomena of electromagnetism. Below is a description found in numerous experiments "strange" magnetic interaction forces, correct explanation that in the framework of the modern theory of electromagnetism can not be found.

1. Experiments AM Ampere Sigalova R., P. Peppisa [27, 39, 40]. When you connect the power to the U-shaped conductor latter comes into linear motion. As part of the well-known concepts such movement is possible only in the interaction of the U-shaped conductor with its own magnetic field. The explanation is based on the assumption that the magnetic field **H,** the side portions of the current 1 2 exerts pressure on the rigid portion of the associated current conductor 3, under the action of which the latter comes into linear motion, dragging current and plots 1, 2, U-shaped conductor. When the loop length of 2-3 times the width on the order of 3 at the magnetic field strength **H** of the conductor 4 to the fixed portion 3 of the movable current U-shaped conductor can be neglected. To resolve the conflict with the laws of mechanics Ampere was admitted the existence of the longitudinal force $\mathbf{F}_{\parallel}$, acting along the conductors 1 and 2, but the existence of this force is contrary to the fundamentals of classical electrodynamics.

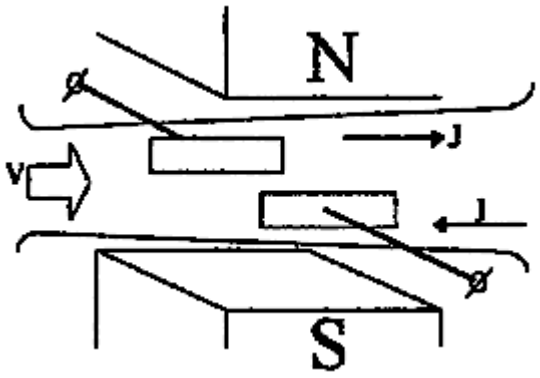


2. Experience of Nikolaev. To resolve the paradox of a U-shaped conductor rigid connection between the conductors of 1.2, 3 fixed.

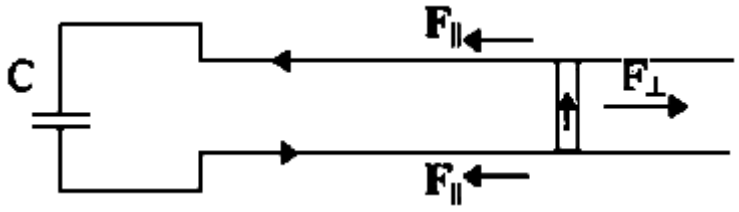
41. Electric motors and generators. So far not found the correct explanation of the reasons unloaded from the magnetic forces of the conductors in the slots of the magnetic armature and stator. The explanation can be found in accounting field vector potential as valued physical quantity and interaction with the field current in the conductors.



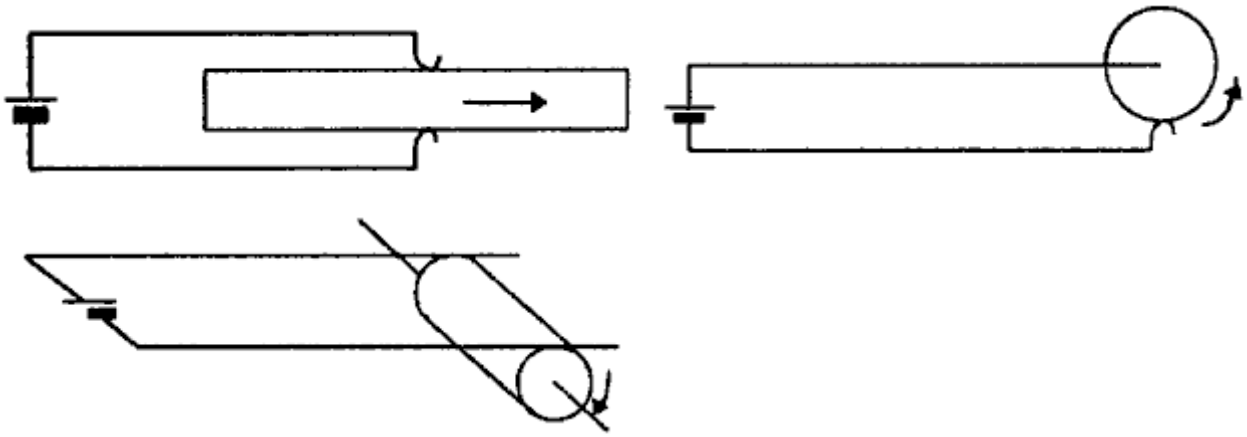
42. MHD generators. To date, not found the correct explanation of parasitic longitudinal currents "end effects" in MHD generators Faraday type when the external load $\mathbf{R}_H = \infty$ in the absence of longitudinal Hall currents. Longitudinal currents at the corners of the winding excitation induced longitudinal forces $\mathbf{F}_\parallel$ magnetic interaction.



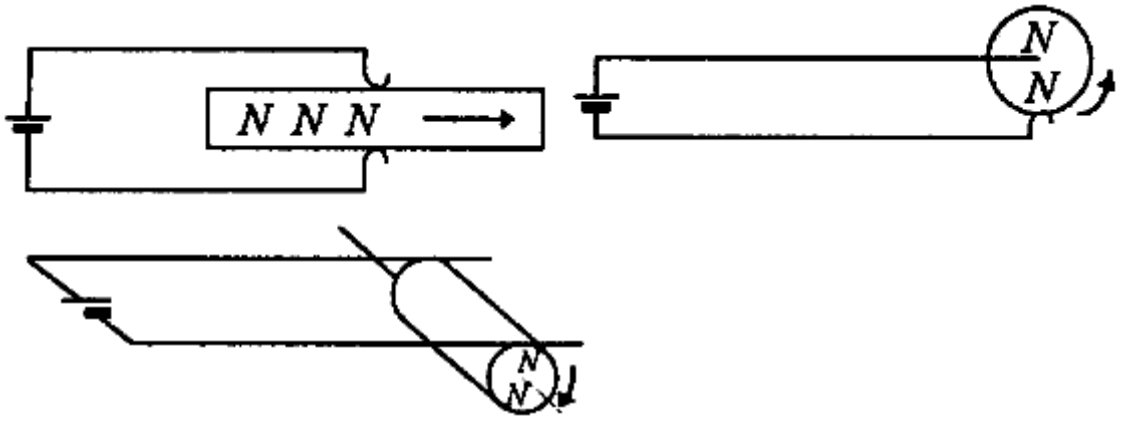
43. railgun engines, cannons, boosters. So far, not found the correct explanation of the forces of reaction and place their applications in devices such as the railgun. Studies show that the forces of reaction are the longitudinal force $\mathbf{F}_\parallel$, and they are attached to the rails along the direction of the current in the vicinity of their current accelerated jumper.



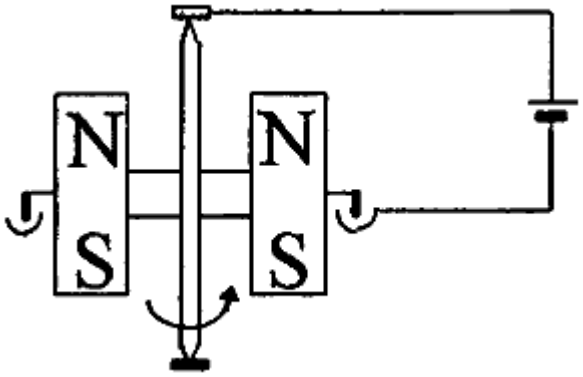
44. Engines railgun type. So far not found the correct explanation of the causes of translational and rotational motion of the conductor at constant size loop. Studies show that the devices work force perpendicular to the magnetic interaction of currents nonpotential type interaction potential energy is zero. Reaction is the longitudinal force $\mathbf{F}_{\parallel}$ interactions that are attached to the conductors-rails.



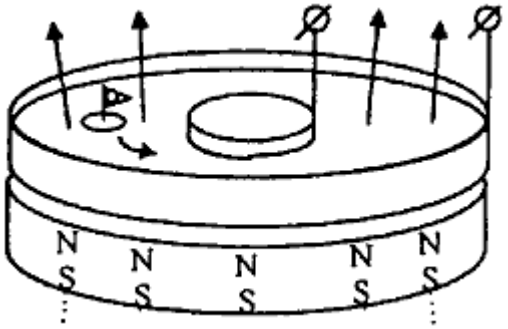
45. Engines railgun type. So far not found the correct explanation of the causes enhancement of the effects of translational and rotational motion of the conductor at constant size of the circuit when the movable conductor is tightly sealed with a permanent magnet. Studies show that driving forces in this case are the longitudinal $\mathbf{F}_{\parallel}$ and transverse $\mathbf{F}_{\perp}$ magnetic interaction force applied to the conductor and the magnet.



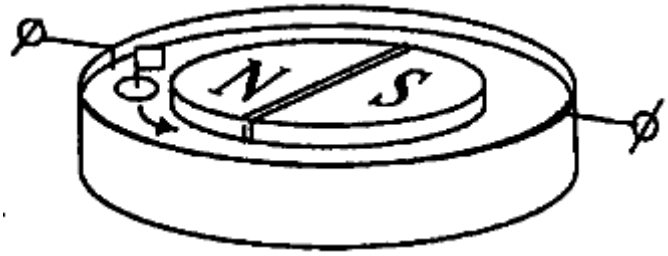
46. Rotation of the magnet poles around the current [47]. In the present apparatus, according to present views, the poles of the magnets interact with the magnetic field along the axial length of the current conductor, on which they are rigidly connected. As a result of this interaction, the magnet and the axial conductor coming into rotary motion due to the effect of self. In fact, the device is equivalent to Faraday unipolar motor (see. Experience 37), which is due to the rotation of the elements longitudinal forces $\mathbf{F}_{\parallel}$. Cross-reaction force $\mathbf{F}_{\perp}$ attached to the side current-carrying conductor.



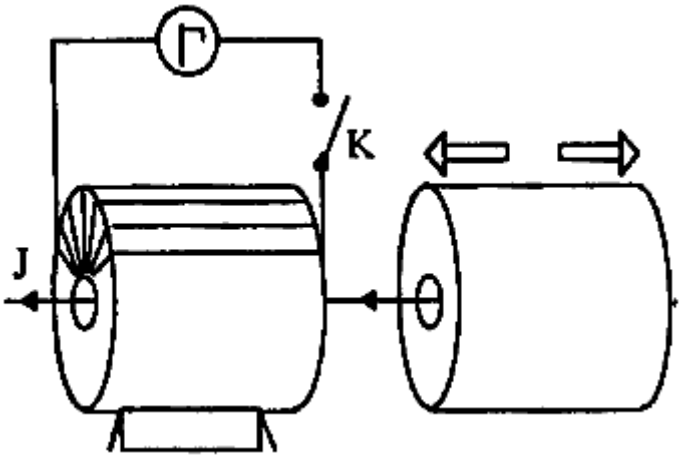
47. The rotation of the liquid in a magnetic field. In the presence of liquid in radial current conductor (electrolyte, mercury) in the magnetic field of the cylindrical magnet liquid comes into rotational motion by the action of shear forces $\mathbf{F}_{\perp}$ Lorentz. The forces of reaction are the longitudinal force $\mathbf{F}_{\parallel}$, and they are attached to the circumference of the magnet.



48. Experience Nikolaev. In the presence of semicircular currents in the conductive liquid (electrolyte) in a magnetic field of the magnets semicylindrical fluid comes into a rotational movement in the direction (counter-current) therein. The driving forces are the longitudinal force $\mathbf{F}_{\parallel}$. Cross-reaction force $\mathbf{F}_{\perp}$ attached to the radial section of the magnets.



49. Experience of Nikolaev. In the author's experience in the fixed core 31 of the magnetic material layer flat wound coil of 100-150 turns of copper fine wire, the ends of which are connected to a galvanometer. In the initial position the chain off of the galvanometer. By placing two 3-axis cores of soft magnetic material copper conductor passes DC 1 = 50A. For a fixed position of the core without coil galvanometer circuit is activated and indicates the normal position of the instrument pointer.



When approaching the axis of the core to the core without coil galvanometer needle wound in the chain winding deviates to one side. With distance from the core to the winding galvanometer needle is deflected in the opposite direction. Exhibit the phenomenon of electromagnetic induction, defines a differential equation of the form

$$\text{dir } \mathbf{E} = \frac{1}{C}\frac{\partial H_{\parallel}}{\partial t} \quad ,$$

due to a change in the core wound induced vector potential **A** (or scalar magnetic field $\mathbf{H}_{\parallel}$) from the core without winding. Due to the closure of the magnetic flux vector of the magnetic field $\mathbf{H}_{\perp}$ core without winding-known differential equation of induction

$$\text{rot } \mathbf{E} = -\frac{1}{C}\frac{\partial \mathbf{H}_{\perp}}{\partial t}$$

not applicable in this case because of the fact that the core space is **M** = 1 and a change in magnetic field $\mathbf{H}_{\perp}$ absent, ie $\partial \mathbf{H} / \partial \mathbf{T} \equiv 0$

In the above list have not shown all the known devices in which the action previously unknown found in Science longitudinal magnetic forces. In addition, the modern electrodynamics remain unknown even numerous "paradoxical" phenomena of electromagnetism related to the laws of electromagnetic induction. For example, there are cases in the presence of loop current induction in the absence of the variable magnetic flux therein or, conversely, lack of induction current in the circuit with a variable magnetic flux therein (Goering paradox). Known paradoxes of induction current in unclosed counter magnetic flux and a number of other "paradoxes", the disclosure of which can be found, unfortunately, in a very limited amount of literature (see., Eg, books, authors Fields Feynman Papaleksi, Bertinova, Kempfer, Franklin , Okolotina et al.).

Thus, we can definitely conclude **that in reality are numerous experimental evidence for the limited-rooted notions of classical electrodynamics.** However, in modern electrodynamics, all is not well in the theoretical underpinnings of the foundations of classical and relativistic electrodynamics due to the fact that the basic concepts of electrodynamics laid not quite true source physical premises.

2. Technique youth. - 1968. - №12; 1969. - №8; 1974. - №12; 1974. - №1; 1982.-№3; 1984.-№1.

8. Feynman R., Leighton R., Sands M. The Feynman Lectures on Physics, Vol. 6. - M .: Mir, 1977. - S. 15 - 30.

15. Nikolaev GV IV. Justification of the reality of the axial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 528-79.

17. Observation of the Aharonov - Bohm // Nature. - 1983. - № 7. - S. 106.

18. M. Danos effect Aharonov - Bohm quantum mechanics electrical transformer // Physics abroad. Ser. B. - M .: Mir, 1984. - S. 100-105.

19. darling BN The theory of the effect Aharonov - Bohm. - Dep. VINITI, reg. № 2931-80.

20. Solunin AM K-electrodynamics and the effects of the vector potential. -Dep. VINITI, reg. № 5416-85.

27. Ampere AM Electrodynamics. - Moscow: USSR Academy of Sciences, 1954.

32. Solunin AM K-Electrodynamics // Interuniversity collection of ISU, Ivanovo, 1982. - Dep. VINITI, reg. № 3908-82.

39.Sigalov RT, Shapovalov TI, Karimov HH, Samsonov NI New driving forces of the magnetic field. - Tashkent: FAN, 1975.

40. Pappas PT The Original Ampere Force and Biot-Savart and Lorenz Forces // H.Nuovo cimento. 11 Agosto. - 1983. - V. 76B. - № 2. - P. 189

41.Graneou P. Electromagnetic jet-propulsion in the direction of carrent flow // Nature. - 1982. - V. 295. - № 5847. - P. 311 - 313.

42.1. Science News. - 1982. - V. 121. - .№ 7. - P. 104.

43.Okolotin VS, Rumyantsev DE Experiments Grano: the power of number 4 or focus? // Engineering and Science. - 1983. -№11. - S. 26 -27.

44. Nikolaev GV Second magnetic field // Engineering and Science. - 1984. - №1. -C. 42 -43.

45. A. Rodin Fog over the magnetic field // Inventor and ratsionalizator.- 1982. -№ 2. - S. 18-19.

46. V. Chernikov As I met with the evil spirit // Technique molodezhi.- 1974. - №1. - P. 37.

47. EA Shtrauf Electricity and Magnetism. -M .: Publishing House of the TTL, 1950.

65. Solunin AM, Kostin AV On the effect of the potential for a toroidal solenoid. - Dep. VINITI, reg. № 7900-84.

66. Nikolaev GV Property of a moving charge to induce an axial magnetic field is a scalar // Application for opening, № 32-OT-10663 from 19.09.82g.

91. Nikolaev GV Unipolar current generator - AS N 1064845 from 06.29.82, the

3. The theoretical paradoxes of electrodynamics

Any physical theory is always possible to identify a number of basic assumptions on which it is based and which define its essential being. Apart from the basic assumptions in the physical theory of a range of additional provisions that may already be common to many physical theories. Completeness same physical theory and its applicability to a good selection of research are determined in the future compliance of all the possible consequences of the physical theory of the fundamental laws of physics - the laws of mechanics, the laws of conservation of momentum and energy, the charge conservation law, the laws of the axiomatic construction and so on. D.

With regard to the modern electrodynamics basic assumptions it is based primarily on the concepts of resting and moving electric charges and fields. These initial concept was known in the time of Faraday and Maxwell and reflect a common understanding of the classical electric charge and its fields. Concept of these lie in the fact that with a stationary electric charge **e** is always associated induction in space about electric field $\mathbf{E}_{to}$ Coulomb type

$$\mathbf{E_k} = \frac{\mathbf{e}}{\mathbf{R}^3}\mathbf{R}, \tag{1}$$

whereas at a uniform rectilinear motion of the electric charge **e** (at $\mathbf{v} << \mathbf{C}$), in addition to the electric field $\mathbf{E}_{to}$ (1), has suggested the induction of the magnetic field **H** , defines dependencies

$$\mathbf{H} = \frac{1}{\mathbf{C}}\frac{\mathbf{e}}{\mathbf{R}^3}[\mathbf{V}\times\mathbf{R}]. \tag{2}$$

In the case of accelerated motion of a charge **e** is assumed induction still vortex electric field **E** :

$$\mathbf{E} = -\frac{1}{\mathbf{C}}\frac{\partial \mathbf{A}}{\partial t} = -\frac{\mathbf{e}}{\mathbf{C}^2 R}\frac{\partial \mathbf{V}}{\partial t}. \tag{3}$$

Both in classical and in modern electrodynamics used a number of additional provisions, such as the principle of superposition for the fields, the concept of space and its metric, the concept of absolute and relative time, the concept of mass, and others.

In the framework of modern concepts in electrodynamics confirmed in basically two fundamentally differing approaches associated respectively with the classical and relativistic approximation. It is generally accepted that the relativistic approximation is appropriate to consider in the case of high speeds at $\mathbf{V} \sim \mathbf{C}$, and applied to electric and magnetic fields in the stationary reference frame from a moving electric charge, this approximation corresponds to the known relationships:

$$\mathbf{E}_p^{'} = \frac{\mathbf{E_k}}{\sqrt{1-\mathbf{V}^2/\mathbf{C}^2}} > \mathbf{E_k}, \tag{4}$$

$$H_p^{'} = \frac{-\frac{V}{C}E_k}{\sqrt{1-V^2/C^2}} > H. \qquad (5)$$

From (4) it follows that the electric field **E** ' $_P$ of the moving charge is no longer the electric field **E** $_k$ (1) of the Coulomb type. Different expression for the magnetic field **H** ' $_P$ (5) from the conventional classical representation **of H** (2). In the case of small velocities with **V** << **C** relativistic expressions for the fields (4), (5) take the trivial form

$$E_p^{'} \approx E_k, \qquad (6)$$

$$H_p^{'} \approx H, \qquad (7)$$

degenerating into ordinary classical expressions for the fields (1), (2). Degeneration of relativistic approximation (4), (5) in the usual classical (1), (2), according to modern ideas, reflects full continuity of these approximations. However, despite the apparent good continuity of classical and relativistic approximation between the two approaches in modern electrodynamics there are fundamental differences. For example, if relativistic approximation basic postulates of the relativity principle are subject not only to the laws of mechanics, but also the laws of electrodynamics and optics, the classical approximation laws of electrodynamics and optics principle of relativity does not obey. In addition, within the framework of classical concepts taking into account the finite speed of light and retardation effects electric field **E** ' $_k$ in the given stationary reference frame from a moving electric charge, in general, may differ significantly from the electric field **E** $_k$ (1) Coulomb-type [12] :

$$E_k' = \frac{e\left(1-V^2/C^2\right)\left(\mathbf{R}-\mathbf{V}/C\,R\right)}{\left(R-\mathbf{V}\mathbf{R}/C\right)^3} < E_k, \qquad (8)$$

that, in principle, can not be obtained within the formalism Lorentz transformation (4) and (5). A similar expression can be obtained for a magnetic field **H** :

$$\mathbf{H}' = \frac{e}{CR^3}\left[\mathbf{V}\times\mathbf{R}'\right], \qquad (9)$$

$$\text{где } \mathbf{R}' = \left(R - \frac{\mathbf{V}\mathbf{R}}{C}\right). \qquad (10)$$

Thus, even without installing another one correspondence and other approaches to the electrodynamics with the laws of mechanics and conservation laws, and despite the seemingly similar initial concept of electric charge and its fields, found significant differences in the predicted these approaches expressions for electric (1) and (4), (8) and magnetic (2) and (5), (9) by moving charge fields. And here we are

talking not only about some abstract expressions, for example, the electric field (1), (4), (8) by moving charge. Each of these expressions is substantially different and determines the physics of the interaction of the electric field established with other resting and moving charges, and this is bound to have the laws of mechanics, conservation laws, and so on. D. A similar situation holds for the different expressions magnetic fields (2), (5) and (9). You can now imagine how to contradictory and paradoxical conclusions can thus come when comparing the consequences of major theoretical approaches to the fundamental laws of physics. If we take into account other source other than the concept of classical and relativistic electrodynamics representations associated, for example, already with the concepts of a material medium, the symmetry of space, long-range and short-range principles, and so on. E., The number of contradictory and paradoxical consequences in the theory of electromagnetism increases significantly. For a visual representation of the essence of some of the contradictions and paradoxes, consider the following series of the most important unsolved problems and contradictions of modern electrodynamics.

1. As in the classical and in the relativistic approximation, the electric field **E** (1) at the observation point r in space around a stationary charge e (R_1), located at the point R ', is determined on the basis of long-range through the charge e , which is known to be at the observation point R :

$$\mathbf{E}(\mathbf{r}) = \frac{e(\mathbf{r}')}{|\mathbf{r}-\mathbf{r}'|^3}(\mathbf{r}-\mathbf{r}'). \tag{11}$$

As a result of assumption (11), on the one hand, the energy $\mathbf{W}_E$ of the electric field **E** (1) a charge e , distributed, for example, on a sphere of radius r_0 and the volume $\mathbf{V}_0$, proves to hold record [7, 47, 48]

$$W_E = \frac{1}{8\pi}\int_{V_o}^{\infty} E^2 dV = \frac{e^2(\mathbf{r}')}{2r_o} \tag{12}$$

From (12) it follows that the energy $\mathbf{W}_E$ of the electric field of the charge is, only the space allocated to the volume is $\mathbf{V}_0$ charging. However, on the other hand, the definition of work **A** charge transfer elements delta e from infinity to a sphere of radius $\mathbf{r}_0$ we find [7, 13, 48]

$$\mathbf{A} = \frac{1}{2}\sum_i \sum_k \frac{\delta e_i \delta e_k}{r_{ik}} = \frac{e^2(\mathbf{r}')}{2r_o}. \tag{13}$$

When quantitatively equivalent to the right-hand side of (12), (13) the physical meaning of the left side of (13) is already significantly different [13]. (13), in particular, that the energy $\mathbf{W}_E$ charge e is concentrated within the volume $\mathbf{V}_0$ of the battery and no energy $\mathbf{W}_E$ (12) of the electric field **E** (1) is in the space volume $\mathbf{V}_0$ should exist.

As part of the famous entrenched notions of empty space and the principle of long-range reveals the contradictions unsolvable.

2. As in the classical and relativistic approximation in electrodynamics does not resolve the contradiction with the definition of total energy, for example, a stationary charge e of the electron with mass m . If the relativistic concepts of the total energy of the electron considered fair-known expression $\mathbf{W}_0 = \mathbf{m}_0 \mathbf{C}^2$, taking into account the presence of the electron e only the rest mass m , it remains unclear meaning and purpose of the electric field energy $\mathbf{W}_E$ (12), (13) the charge e the electron and its relation to the total energy $\mathbf{W}_0$.

In the framework of classical and relativistic concepts of mechanical and electromagnetic mass and the existence of only one type of magnetic field **H** = ROT **A** contradiction is insoluble.

3. In the modern electrodynamics hitherto not resolve the contradiction with the nature of the rest mass m_0 of the charge e of the electron.

If the total energy $\mathbf{W}_0$ corresponds to the electron rest mass of the electron $m_0 = \mathbf{W}_0 / \mathbf{C}^2$, the electric field energy $\mathbf{W}_E$ (12) corresponds to the electron mass $m_E = 1/2\ m_0$. It remains unclear what relationship there is mass m_E of the electric field with full rest mass m_0 of the electron? If we assume that the mass m_E is part of the rest mass m_0 of the electron, then there are other contradictions. So far, physics found evidence of the mass m_E of the electric field of inertial properties. It remains an open question about the presence of mass m_E of the electric field of gravitational properties.

4. Within the framework of classical and relativistic notions approximation **V** << **C** strength of the electrical interaction between two stationary charge is determined by Coulomb's law on the principle of action at a distance

$$\mathbf{F} = \frac{e_1 e_2}{R^3}\mathbf{R}, \qquad (14)$$

which eliminates the possibility of determining the localization of the interaction energy $\mathbf{U} = e_1 e_2 / R_{12}$ of these charges.

In the framework of the empty space of symmetric and non-physical principle of long-range behavioral difficulties can not resolve.

5. As part of the well-known concepts in electrodynamics in determining the interaction energy **U** of two charges e_1 and e_2 known integral dependence

$$\mathbf{U}_{B3} = \frac{2}{8\pi}\int_V \mathbf{E}_1 \mathbf{E}_2 \mathrm{d}V \qquad (15)$$

found difficulty in establishing the physical nature of the interaction energy ($\mathbf{E}_1$, $\mathbf{E}_2$ delta **V**) and the nature of its distribution in space about the charges.

In the framework of the empty space of symmetric detectable difficulty persists.

6. Taking into account the admissibility in modern electrodynamics fundamentally different from one another expression for the electric field **E** is uniformly and rectilinearly moving charge (1), (4), (8),

found fundamental contradictions in statements about the physical nature of the change in the energy of these fields in increasing the velocity of the charge. For example, according to (1), the energy $\mathbf{W}_E$ of the electric field

$$W_{E_K} = \frac{1}{8\pi}\int_V E_k^2 dV \tag{16}$$

in the space around a moving charge at $\mathbf{V} \rightarrow \mathbf{C}$ remains constant. According to (8), the energy $\mathbf{W}_E$ of the electric field

$$W_{E_K'} = \frac{1}{8\pi}\int_V E_k'^2 dV \tag{17}$$

when $\mathbf{V} \rightarrow \mathbf{C}$ tends to zero. However, according to (4), the energy of the electric field

$$W_{E'} = \frac{1}{8\pi}\int_V E'^2 dV \tag{18}$$

when $\mathbf{V} \rightarrow \mathbf{C}$ tends to infinity. Similar contradictory physical situations occur and energy of the magnetic field of the moving charge.

7. In the approximation $\mathbf{V} << \mathbf{C}$ so far in electrodynamics does not resolve the contradiction with the total energy $\mathbf{W}$ moving with velocity $\mathbf{V}$ charge e of the electron with mass m_0. According to the relativistic view, the total energy of the electron is assumed equal

$$W = mC^2 \approx m_o C^2 + \frac{m_o V^2}{2} = W_o + W_K, \tag{19}$$

ie energy $\mathbf{W}_0$ electron at rest and kinetic energy $\mathbf{W}_K = m_0 \mathbf{V}^2 / 2$ mass m_0 of the electron. However, in (19) reflects the functional dependence of the energy $\mathbf{W}$ of the electron only on its mass m_0, meanwhile, as is well known, some of the energy of the electron is also connected with its electric $\mathbf{E}$ and magnetic $\mathbf{H}$ fields. If we consider that the energy of the electric field of the electron is

$$W_E = \frac{1}{2} m_o C^2 = \frac{1}{2} W_o, \tag{20}$$

and the energy of the magnetic field

$$W_H = \frac{2}{3} W_K, \tag{21}$$

then the total energy moving with velocity **V** of the electron should seemingly be written

$$W = W + W_E + W_H = \frac{3}{2} W_o + \frac{2}{3} W_K , \qquad (22)$$

which is unacceptable. Are unacceptable and any other assumptions, assuming for example that the electric power $\mathbf{W}_E$ (20) or magnetic $\mathbf{W}_H$ (21) fields included in the total energy rest $\mathbf{W}_0 = m_0 \mathbf{C}^2$ electrons. If we assume that the energy $\mathbf{W}_0$ includes an electron energy of electric and $\mathbf{W}_E$, and magnetic $\mathbf{W}_H$ fields, there are serious doubts as to the physical nature of the rest mass m_0 of the electron.

8. So far in electrodynamics not resolve the contradiction with the nature of inertial mass m_0 of the charge e of the electron [25]. The presence of moving with velocity **V** charge e of the electron kinetic energy $\mathbf{W}_K = (m_0 \mathbf{V}^2) / 2$ corresponds to the presence of the electron inertial rest mass m_0 . However, taking into account the fact that moving with velocity **V** of the electron has not yet equal to zero magnetic field energy $\mathbf{W}_H$ (21), then the value of the inertial mass m_H magnetic field electron set

$$m_H = \frac{2}{3} m_o . \qquad (23)$$

Given the same as with the electric field of an electron bound energy $\mathbf{W}_E$ (20), for the applicable mass m_E of the electric field the electrons are

$$m_E = \frac{W_E}{C^2} = \frac{1}{2} m_o . \qquad (24)$$

Location for a complete inertial mass m of the electron, it would seem, should be written

$$m = m_o + m_H + m_E = 2\frac{1}{6} m_o , \qquad (25)$$

from the physical point of view, is unacceptable.

If we assume that the electric field **E** of the electron inertial and gravitational properties does not, then there are other quantitative discrepancies. In addition, up to the present time in physics is not resolved the question about the presence of the mass m_H magnetic field gravitational properties.

As part of the well-known concepts in electrodynamics of a magnetic field **H** = ROT **A** and electromagnetic mass insoluble contradiction.

9. With the acceleration of the charge e of the electron with mass m_0 to the speed **V << C** expended work $\mathbf{A} = \mathbf{U}\, e = m_0 \mathbf{V}^2 / 2$, but at a speed **V** in the charge e of the electron has a more magnetic energy $\mathbf{W} = 2\, \mathbf{W}_K / 3$ (21). So far, the relationship remains unclear magnetic field energy $\mathbf{W}_H$ with a kinetic

energy $\mathbf{W}_K$ electron charge. This relationship is confirmed doubtfulness nonlinear dependence of the magnetic energy $\mathbf{W}_H$ of the number of charged particles with the apparent linear dependence of kinetic energy $\mathbf{W}_K$ by the same number of particles [25].

As part of the well-known concepts in electrodynamics of a magnetic field **H** = ROT **A** contradiction can not be solved.

10. Work in your own vortex electric field $\tilde{\mathbf{E}}$ (3) self-inductance of the charge e of the electron when accelerating it up to speed **V** << **C** is equal to

$$A = \tilde{E}\, e\, \Delta x, \tag{26}$$

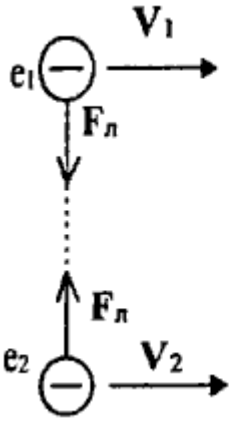
that is why some 3/2 of the total energy of the magnetic field $\mathbf{W}_H$ (21) of the electron, and the change which is generated by its vortex electric field.

As part of the well-known concepts of a magnetic field **H** = ROT **A** contradiction is insoluble.

11. In the space of about moving with velocity **V** << **C** charge e induced field vector potential **A** , the function **A** is spherically symmetric. Field **A** in the space around a moving charge corresponds to the magnetic field $\mathbf{H}_\perp$ = ROT **A** , but the magnetic field $\mathbf{H}_\perp$ localized for some reason only in the radial direction from the charge, while the direction of motion of the charge against the magnetic field $\mathbf{H}_\perp$ zero. At the same time it is known [49] that in the direction of motion of the charge e and turns against the non-zero field $\mathbf{H}_\parallel$ -div = **A** . What is this field from the physical point of view, in modern electrodynamics remains unknown.

12. In the framework of classical and relativistic electrodynamics representations approximation **V** << **C** magnetic interaction between two moving charges e_1 and e_2 is determined by the Lorentz formula (27)

In the particular case of two parallel moving at the same speed $\mathbf{V}_1 = \mathbf{V}_2 = \mathbf{V}$ charge e_1 and e_2, provided (**V** • R) = 0 (see. Fig.), the strength of the magnetic interaction $\mathbf{F}_L$ is equal to (28)



$$\mathbf{F}_л = \frac{e_1}{C}[\mathbf{V}_1 \times \mathbf{H}_2]. \tag{27}$$

$$\mathbf{F}_л = \frac{e_1 e_2 V_1 V_2}{r^2 C^2}. \tag{28}$$

Current power $\mathbf{F}_A$ (28) corresponds to the magnetic interaction energy $\mathbf{W}_L$ which can be defined work transfer, for example, charge e_1 at its fixed speed $\mathbf{V}_1 = \mathbf{V}_2 = \mathbf{V}$ from the initial distance to infinity [16]

$$A = \int_{r_{12}}^{\infty} \mathbf{F}_{\pi}\, d\,\mathbf{r} = \frac{e_1 e_2 V_1 V_2}{r_{12} C^2}. \qquad (29)$$

Similar energy $\mathbf{W}_A$ magnetic interaction can be determined and from another known in electrodynamics according to the interaction of the charge e_1 with a vector potential $\mathbf{A}_2$ other [13]:

$$W_A = -\frac{1}{C}\mathbf{A}_2\, e_1\, \mathbf{V}_1 = \frac{e_1 e_2 V_1 V_2}{r_{12} C^2}. \qquad (30)$$

In addition, similar to the energy $\mathbf{W}_E$ and the magnetic interaction is established from the work of simultaneous acceleration of charges e_1 and e_2 to velocities $\mathbf{V}_1 = \mathbf{V}_2 = \mathbf{V}$ in cross vortex electric field $\mathbf{E}$ of the charges [50]:

$$W_{\tilde{E}} = \tilde{\mathbf{E}}_1\, e_2 \Delta x + \tilde{\mathbf{E}}_2\, e_1 \Delta x = \frac{e_1 e_2 V_1 V_2}{r_{12} C^2}, \qquad (31)$$

where x - a stretch of road on which the charges are accelerated to a velocity $\mathbf{V}$. However, if the energy of the magnetic interaction $\mathbf{W}_H$ of the same charges to determine well-known in modern electrodynamics integral dependence

$$W_H = \frac{1}{8\pi}\int_V \mathbf{H}_1 \mathbf{H}_2 dV \qquad (32)$$

directly through the magnetic field $\mathbf{H}_{\perp 1}$ and $\mathbf{H}_{2\perp}$ these charges, then, surprisingly, we find

$$W_H < A \cong W_A \cong W_{\tilde{E}}. \qquad (33)$$

As part of the well-known concepts in electrodynamics of a magnetic field $\mathbf{H}_{\perp}$ = ROT $\mathbf{A}$ contradiction is insoluble.

13. As part of the well-known concepts in electro- magnetic interaction force $\mathbf{F}_H$ parallel to the moving charges e_1 and e_2 in the case of ($\mathbf{V} \cdot \mathrm{R}$) = 0 (See above. Fig. to n. 12) can be determined by the magnetic interaction energy $\mathbf{W}_H$ (32) dependence of the form

$$\mathbf{F}_H = -\frac{\partial W_H}{\partial \mathbf{r}}. \qquad (34)$$

However, this force $\mathbf{F}_H$ (34) is somehow less known in electrodynamics Lorentz force $\mathbf{F}_L$ (27), ie we have

$$F_H < F_Л. \tag{35}$$

Similar disparities are found and for the forces of magnetic interaction

$$F_H < F_A, \quad \text{где} \quad F_A = \frac{\partial W_A}{\partial r}, \tag{36}$$

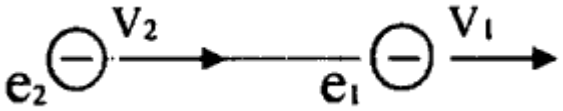
$$F_H < F_{\tilde{E}}, \quad \text{где} \quad F_A = \frac{\partial W_{\tilde{E}}}{\partial r}, \tag{37}$$

defined in terms of the interaction energy $\mathbf{W}_A$ (30) with the vector potential and through the work $\mathbf{W}_{\tilde{E}}$ (31) in the cross-vortex electric field **E** (3), ie, set contradictory relation of the form

$$F_H < F_Л \equiv F_A = F_{\tilde{E}}. \tag{38}$$

As part of the well-known concepts in electrodynamics of a magnetic field $\mathbf{H}^{\perp}$ = ROT **A** contradiction is insoluble.

14. As part of the well-known concepts in electrodynamics Lorentz force $\mathbf{F}_L$ for the magnetic interaction between two moving in a straight line at speeds $\mathbf{V}_1 = \mathbf{V}_2 = \mathbf{V}$ charges e_1 and e_2 (see. fig.) is equal to zero.



This force $\mathbf{F}_L = 0$ corresponds to the energy of the magnetic interaction of $\mathbf{W}_L = 0$, determine the work of transferring **And** one of the charges in a straight line to infinity at a fixed rate of another. However, if the energy of the magnetic interaction of $\mathbf{W}_A$ (30) charges e_1 and e_2 to determine the known dependence of the interaction of a single charge with the vector potential of another, we find $\mathbf{W}_A \neq 0$. A similar non-zero magnetic interaction energy $\mathbf{W}_{\tilde{E}} \neq 0$ can be found from the work $\mathbf{W}_{\tilde{E}}$ (31) in the cross-vortex electric fields accelerated to a velocity $\mathbf{V}_1 = \mathbf{V}_2 = \mathbf{V}$ charges. Moreover, even from well-known in the electrodynamics of integral dependence for the magnetic interaction energy $\mathbf{W}_H$ (32) moving in a straight line charges also set a non-zero value of $\mathbf{W}_H \neq 0$ .. The result is a contradictory relationship to the magnetic interaction energy

$$W_A \equiv W_{\tilde{E}} > W_H > W_Л \equiv 0 \tag{39}$$

at different ways of determining this. As part of the well-known concepts in electrodynamics of a magnetic field **H** = ROT **A** detectable contradiction is insoluble.

15. As part of the well-known concepts in electrodynamics at zero Lorentz force $\mathbf{F}_L$ for the magnetic interaction of moving in a straight line charges e_1 and e_2 (see. fig. to n. 14), for non-zero force $\mathbf{F}_H$ previously unknown to science longitudinal magnetic interaction of the well-known integral relation for the magnetic interaction energy

$$W_H = \frac{2}{8\pi}\int_V \mathbf{H}_1\mathbf{H}_2 dV \tag{40}$$

directly install

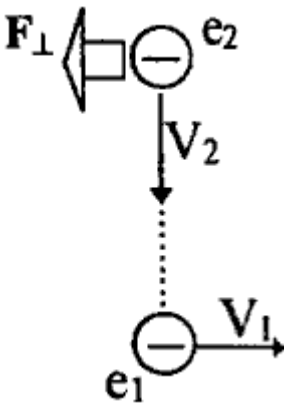
$$\mathbf{F}_{\mathrm{H}} = -\frac{\partial \mathrm{W}_{\mathrm{H}}}{\partial \mathbf{r}}. \qquad (41)$$

However, if the force $\mathbf{F}_{\parallel}$ determine the longitudinal magnetic interaction through other well known function $\mathbf{W}_{\mathrm{A}}$ (30) or $\mathbf{W}_{\tilde{\mathrm{E}}}$ (31) for the energy of the vector potential interaction or through work in electric fields cross vortex motion in a straight line in the form of charges $\mathbf{F}_{\mathrm{A}}$ (36) and $\boldsymbol{F}_{\tilde{E}}$ (37), we find a strange relationship:

$$\mathrm{F_A} \equiv \mathrm{F_{\tilde{E}}} > \mathrm{F_H} > \mathrm{F_Л} \equiv 0. \qquad (42)$$

As part of the well-known concepts in electrodynamics of a magnetic field **H** = ROT **A** reveals the contradictions unsolvable.

16. As part of the well-known concepts in electrodynamics found that the interaction of two charges e_1 and e_2, moving in the same plane in perpendicular directions (see. fig.), on a charge e_2 valid non-zero magnetic Lorentz force from the charge e_1, while the charge of e_1, the magnetic force on the part of the charge e_2 is equal to zero. There is a flagrant violation of the third law of mechanics, electrodynamics [13]. As part of the well-known concepts in electrodynamics of a magnetic field **H** = ROT **A** detectable contradiction is insoluble.



17. As part of the well-known concepts in electrodynamics expression for the magnetic field **H** (R) at the observation point r is determined on the basis of long-range through the moving charge q (R ') (current element), located at the reference point R '. As a result, the differential equations of electrodynamics for the whole space outside the scope of a moving charge q (R ') (current element) loses its physical meaning and in solving the system of equations through the current transfer is necessary to use a purely formal mathematical methods, additional conditions, primed coordinates, δ-function and t. d.

18. As part of the well-known classical concepts generally accepted that in the space around a moving charge e (R ') induced displacement currents

$$\mathbf{j}(\mathbf{r}) = \frac{1}{4\pi}\frac{\partial \mathbf{E}(\mathbf{r})}{\partial \mathrm{t}}, \qquad (43)$$

however, the immediate, short-range reflects the physical principle, the functional relationship between the displacement currents J (R ') at the observation point r and induced at the same point magnetic fields **H** (R) to date in electrodynamics found.

19. As part of the well-known concepts in electrodynamics for the case of open currents and single moving charges correct solution of Maxwell's equations can not be found, as in this case, we have div **A**

≠ 0 [14, 49]. If using known methods of formal decision yet obtained, the substitution of the solution found in the original Maxwell's equations reveals their incorrectness.

20. As part of the well-known concepts in electrodynamics for the case of a single moving charge (**V** << **C**) formal solutions of Maxwell's equations through some bias currents [12] provide for the magnetic field **H,** the same result as in the current account of the transfer [10]. Since the bias currents moving charge coexist with the current transfer of the moving charge, while taking into account that these currents, we need to get to the point of observation to twice the value of the magnetic field **H** or consider one of the current mathematical abstraction. When any of these assumptions questioned the validity of the conventional Maxwell equations while taking into account the current transfer and bias currents.

21. As part of the well-known concepts in electrodynamics in the formal decision of Maxwell's equations for the electromagnetic field in vacuum is necessary to introduce a purely formal mathematical additional conditions, normalization, calibration, and other attributes of the mathematical formalism of the wave equation for the field, the physical meaning of which can not be understood. As part of the well-known concepts in electrodynamics of a magnetic field **H** = ROT **A** behavioral difficulties are inevitable.

Apart from the above contradictions and paradoxes in theoretical justification of assumptions of modern electrodynamics, there are a number of other equally serious contradictions associated with the already limited relativistic representations with respect to the real near-Earth space. Analysis of numerous accumulated to date experimental material in the field of mechanics, optics and electrodynamics shows [23, 24] that the real near-Earth space and the gravitational field of the physical vacuum in their physical properties significantly different from the absolutely empty abstracted space of the special theory of relativity (STR) or covariant space of general relativity (GR). In particular, research has shown that in relation to the real near-Earth space and the gravitational field of the physical vacuum relativity principle is applicable not only to optical and electrodynamic phenomena [34], but also any mechanical phenomena. As part of the service stations in the analysis of optical phenomena observed striking asymmetry of these phenomena with respect to resting on the surface of the Earth "laboratory" reference system and any moving relative to it. For example, in 1912 in the Sagnac type experiments, it was found that in the resting position the platform with respect to the optical device pass the earth's surface while a light beam of a closed circuit unit in one and opposite directions is the same. However, if the platform with the tool in rotation with respect to the earth's surface while a light beam passing in a closed loop and reverse directions is already uneven. In other words, in the rest of the device speed of light in a reverse direction and the contour is constant relative to the surface as a massive gravitating body of the Earth, and with respect to the device, its own gravitational mass is negligible. When the device is rotated relative to the earth's surface, the speed of light in one and the reverse directions is constant, again relative to the surface of the Earth gravitational body bulk, since the rotation of the device relative mass which is negligible, no changes to the physical conditions on the propagation of light Earth's surface. At the same time relatively rotating the device the speed of light, of course, has asymmetric turns on and against the direction of rotation, and that in fact found in the experiments. As noted at the time [51], the positive results of experiments Sagnac type is a brilliant proof of preferential frame of reference for the light, however, the accuracy of the experiments the time was still not enough to clearly answer the following question: interested in whether the preferential system of reference light with Earth as a whole with its daily rotation or lags? Failure to respond to this question allowed the supporters of relativistic notions attempt to circumvent the difficulties detected by reference to the fact that the results of optical experiments Sagnac type [52-54] is possible to consider as part of general relativity. It is known [55]

that, according to the methods of general relativity, the frame of reference for the world in any rotating frame of reference must keep up with the rotation, which seems to be in good agreement with the positive results of experiments Sagnac type. However, the results others have more recent and more accurate, experiments have shown [56-60] that up to cm / s, the speed of light on the surface of the Earth's massive gravitating body shows remarkable consistency in all directions, regardless even of their own daily rotation of the Earth. Consequently, within the concept of general relativity, the frame of reference for the world is really behind the rotation, if relative to the surface of a massive gravitating body of the Earth revolves device relative mass is negligible. However, if as a rotating frame of reference is considered itself a massive gravitating body of the Earth, the frame of reference for the world is already fully enjoys a rotating system. A similar asymmetry laboratory and moving frames of reference and found an overall analysis of electrodynamic phenomena in the conditions on the Earth's surface [33-38, 61-63]. From the consideration that the restriction of entrenched ideas of general relativity as applied, for example, to the real near-Earth space and the gravitational field of the physical vacuum is found primarily in the fact that these representations ignore clearly different physical conditions that may be associated with one another and rotating reference frame. Such an abstract, in fact, the approach to the description of the methods GTR rotating reference systems found in other paradoxical conclusion that theory associated with the already artificially imposed restrictions on the size of rotating systems [55].

Thus, there appears a significant limitation of the classical and relativistic electrodynamics and representations in relation to the real near-Earth space and the gravitational field of the physical vacuum, and generally everything around us real space. These circumstances are even more general poor state of stress in modern electrodynamics and the urgent need to review all of its original position.

7.Feynman R., Leighton R., Sands M. The Feynman Lectures on Physics, Vol. 5. - M .: Mir, 1977. - S. 152 - 172.

10. Nikolaev GV 1. Displacement currents and radial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep VINITI, reg. № 3487-78.

12. Levich, VG Course of Theoretical Physics, Vol 1 - M .: Nauka, 1969.-S. 32.45, 104-110.

13. IE Tamm Fundamentals of the theory of electricity. - M .: Nauka, 1976. - S. 78 - 83,230,233,370,400.

14. J. Maxwell. Selected works on the theory of the electromagnetic field. - M .: Gostekhizdat, 1954.

16. Nikolaev GV VIII. On the nature of the vortex electric field gradient moving charge. - Dep. VINITI, reg. № 5812-85.

23. Nikolaev GV The laws of mechanics and electrodynamics near-Earth space. Vol. 1. - S. 541 (R & D. - State. Register. № 74007254, B324555otU. 1974.).

24. Nikolaev GV The limits of applicability of classical and relativistic electrodynamics in near-Earth space. Vol. 2. - P. 164 (R & D. - State. Register. № 74007254, B340882 from X. 1974).

25. GV Nikolaev, Okulov BV On the inertial properties of the electrons / Ed. Zh."Math. Universities. Physics." - Tomsk, 1978. - Dep. VINITI, reg. № 4399-77.

34. GV Nikolaev, Okulov BV On the exponential justify the principle of relativity / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 3064-74.

47. EA Shtrauf Electricity and Magnetism. -M .: Publishing House of the TTL, 1950. - S. 91,98,348.

48. Frisch SE, AV Timoreva General physics course. T. 2. - M .: Publishing House of the TTL, 1957.-S. 68.

49. AS Kompaneetc Theoretical physics. -M .: Publishing House of the TTL, 1957. - S. 126-128.

50. Nikolaev GV IX.Vortex electric field is rapidly moving charge and the laws of inertia charges. - Dep. VINITI, reg. № 5813-85.

51. SI Vavilov Works. 4. T. - M .: AN SSSR, 1954.

52. Sagnac G .// Compt. rend. - 1913. - V. 157.-P. 508.

53. Pogany P .// Ann. Phys.- 1926. -V. 80. -P. 217 -231.

54. Macec WM Davis DT // Appl. Lett.-1963. -V. 2. - P. 67-68.

55. Landau LD, Lifshitz EM Field theory. - M .: Nauka, 1973.

56. Cedarholm IP, Bland GF, Haven BL, Tawnes CH // Phys. Rev.Lett. - 1958. - V. 1. - P. 342 - 343.

57. Iaseja TS, laven A., Murray I., Tawnes CH // Phys. Rev.Lett. - 1964. - V. 133a. - P. 1221 - 1223.

58. Champney DC, Moon PB // Proc. Phys.Soc. - 1961. - V. A77. - P.350 -351.

59. Champney DC, Isaac GP, Khan M .// Phys. Lett. - 1963. - V. 7. -P. 241- 243.

60. Cialdia P .// Lett. Nuovo cim. - 1972. - V. 4. - № 16. - P. 821 - 825.

61. Nikolaev GV Optical and near-Earth space electrodynamic asymmetry // Application for opening, № 32-RT-8857 of 1975

62. GV Nikolaev, Okulov BV Lavrov MD A device for measuring the speed, mobility and concentration of the sign carriers of electric current in a solid // Application for invention. AS Number of 13.06.77g 661,656. Bull. Number 17, 1979.

63. GV Nikolaev, Petrik VA device for measuring the angular velocity of rotation of the object // Application for invention. AS Number of 19.12.78g 777,581. Bull. №41, 1980.

---

4. Possible improvements in electrodynamics

But let us return now to our time if we take into account what is now considered already quite significant existence of a special protection of the physical vacuum, and that describes the properties of the physical vacuum (electric $\mathbf{E}_0$, magnetic μ_0 , polarizability, quantized, and so on. d.) are consistent fluid properties of electromagnetic fields, is quite obvious urgent need to revisit the original model equations of electrodynamics, so that they can once again find their initial physical essence. To improve the same equations of electrodynamics, as is now becoming apparent, there is only finally put into them, first of all, the physical principle of a short and obtain a consistent system of differential equations of electrostatics and complete system of differential equations of electrodynamics for the two types of magnetic fields $\mathbf{H}_\perp$ = ROT **A** and $\mathbf{H}_\parallel$ -div = **A** , expressing them now, in accordance with the principle of short-range, only through some bias currents. And that was enough to immediately disappeared almost all the above contradictions and paradoxes in the interpretation of the observed phenomena really electromagnetism. Disappeared at the same time and most of the difficulties and contradictions in the

theoretical underpinnings of the original representation of the laws of electromagnetism. Laws of electrodynamics were now in full compliance with the fundamental laws of mechanics. To eliminate the remains of contradictions is necessary to clarify a few of our ideas about the mechanical, electromagnetic and gravitational mass, the deformation of the electric fields of moving charges, the nature of the kinetic energy of a moving charge, and so on. D. The sequence of improvement equations of electrostatics and electrodynamics can be, for example, follows.

1. Based on the notion of the existence of physical vacuum environment [23], established a significant limitation of the classical and relativistic electrodynamics concepts in the real near-Earth space [24, 33-38]. From a consideration of both mechanical and electromagnetic phenomena in the real space and from the general benchmarking gained so far experimental data in the field of optics and electrodynamics concluded that non-compliance with the principle of relativity to the laws of mechanics, optics and electrodynamics in real physical space and the possibility of its implementation only in some local areas, and only for physically equivalent reference systems. **Accounting for the relationship between inertial systems with massive gravitating bodies and gravitational fields, without which there is the existence of a real space, leads to the need to abandon the principle of relativity as a fundamental principle.** The laws of mechanics, electrodynamics and optics remain fair and do not alter its kind only to physical equivalence of inertial systems. The equations of mechanics, electrodynamics and optics can be invariant only in a totally empty no physical space, as no single point of real physical space can not be simultaneously in the same physical conditions in two different moving relative to each other systems, even if these systems are inertial and physically equivalent. Finding the equations of motion of material particles, electric and magnetic fields in a single coordinate system is physically real space from the corresponding equations of motion, the electric and magnetic fields of the other system is possible only when the extent that the physical equivalence of the reference frame. Optical and electrodynamic real asymmetry of near and outer space due to the properties of the physical vacuum of real space and its relation to the gravitational fields of massive gravitating systems [61].

2. Taking into account the electromagnetic properties of the physical vacuum is real near-Earth space [64-71] is the functional relationship of the electric field **E** (R) at the observation point R , induced at rest in the laboratory on Earth's surface charge e (R '), with a surface density σ_0 (R) vacuum polarization charges of the medium at the same point g, which is in full compliance with the short-range physical principle [70]

$$\mathbf{E}_o(\mathbf{r}) = 4\pi\ \sigma_o(\mathbf{r})\frac{\mathbf{R}}{R}, \qquad (1)$$

where

$$\sigma_o(\mathbf{r}) = \frac{e_o}{4\pi R^2}. \qquad (2)$$

Polarization charge $e_0 \equiv e$ vacuum environment on the surface of a sphere surrounding the charge e and the intersecting point of observation R , determined from the condition of applicability to the electric field **E** (R) stationary charge e (R ') Gauss theorem.

3. to determine the legality of the electrostatic interaction of the charge e_2 with the electric field $\mathbf{E}_{01}$ (1) of the charge e_1 (Coulomb's law) in the medium of the physical vacuum, reflecting the physical principle of the short-range

$$\mathbf{F} = 4\pi\sigma_{01} e_2 \frac{\mathbf{R}}{R}. \tag{3}$$

4. The energy $\mathbf{W}_E$ of the electric field $\mathbf{E}_0$ (1) the charge e in real space gets a trivial interpretation as working medium polarization of the physical vacuum

$$W_E = \frac{1}{2}\int_{r_o}^{\infty} \mathbf{E}_o\, e_o\, d\,\mathbf{r} = \frac{1}{2}\frac{e^2}{r_o}. \tag{4}$$

Expression (4) is completely equivalent to the well-known expression for the energy $\mathbf{W}'_E$ of the electric field $\mathbf{E}$ of charge, written in the form

$$W'_E = \frac{1}{8\pi}\int_v \mathbf{E}^2\, dV = \frac{1}{2}\frac{e^2}{r_o}. \tag{5}$$

5. The interaction energy U of electric charges e_1 and e_2 is determined easily interpreted, from a physical point of view, the work environment of the physical vacuum polarization in cross electric fields $\mathbf{E}_{01}$ and $\mathbf{E}_{02}$

$$U = \frac{1}{2}\int \mathbf{E}_{01}\, e_{02}\, d\,\mathbf{r}_1 + \frac{1}{2}\int \mathbf{E}_{02}\, e_{01}\, d\,\mathbf{r}_2 = \frac{e_1 e_2}{r_{12}}. \tag{6}$$

Expression (6) is equivalent to the well-known expression for the interaction energy of the electric fields $\mathbf{E}_1$ and $\mathbf{E}_2$ charges e_1 and e_2

$$U = \frac{1}{8\pi}\int_v \mathbf{E}_1\mathbf{E}_2\, dV + \frac{1}{8\pi}\int_v \mathbf{E}_2\mathbf{E}_1\, dV = \frac{e_1 e_2}{r_{12}}. \tag{7}$$

6. Found a consistent system of differential equations for the electric field $\mathbf{E}_0$ (1) at the observation point R , which reflects the short-range physical principle [70]

$$\text{rot}\, \mathbf{E}_o(\mathbf{r}) = 0, \tag{8}$$

$$\text{div}\, \mathbf{E}_o(\mathbf{r}) = 4\pi\rho_o(\mathbf{r}), \tag{9}$$

$$\mathbf{E}_o(\mathbf{r}) = -\,\text{grad}\,\varphi_o(\mathbf{r}), \tag{10}$$

where $\rho_0(R)$ - density of polarization charges vacuum environment at the observation point R, determines the dependence

$$\rho_o = \frac{e_o}{4\pi R^2 dR} = \frac{e_o}{dV}. \qquad (11)$$

The system of equations (8) - (10) can easily be reduced to the Poisson equation, the decision of which is no longer used mathematical formalism primed coordinates and **δ** -function.

7. Based on the representation of the reality of bias currents j_{see} in the medium of the physical vacuum around a moving charge

$$\mathbf{j}_{CM} = \frac{1}{4\pi}\frac{\partial \mathbf{E}_0}{\partial t}, \qquad (12)$$

established their functional relationship with the principle of a short induced by these currents by magnetic fields $\mathbf{H}_\perp$ and $\mathbf{H}_\parallel$: [10, 15, 16, 21, 22, 25, 26, 50, 72-78]

$$H_\perp = \frac{1}{C}\frac{2J_{CM_\parallel}}{r_o} = \frac{1}{C}\frac{eV}{r^2}\sin\varphi, \qquad (13)$$

$$H_\parallel = \frac{1}{C}\frac{2J_{CM_\perp}}{x_0} = \frac{1}{C}\frac{eV}{r^2}\cos\varphi, \qquad (14)$$

where

$$\mathbf{J}_{CM_\parallel} = \int_{S_o} \mathbf{j}_{CM_\parallel} d\mathbf{S}, \qquad (15)$$

$$(\mathbf{j}_{CM} = \mathbf{j}_{CM_\parallel} + \mathbf{j}_{CM_\perp}),$$

$$\mathbf{J}_{CM_\perp} = \int_{S6} \mathbf{j}_{CM_\perp} d\mathbf{S}. \qquad (16)$$

Surface $\mathbf{S}_0$ restricts the flow of axial displacement current $\mathbf{J}_{sm\parallel}$ (15). On its outer surface is sought magnetic field $\mathbf{H}_\perp$ (13). Surface $\mathbf{S}_\sigma$ limits radial flux bias current $\mathbf{J}_{sm\perp}$ (16). On its outer surface is sought magnetic field $\mathbf{H}_\parallel$ (14).

8. Through the unique value of a physical parameter of the vector potential **A** moving charge e (**V** << **C**),

$$\mathbf{A} = \frac{\mathbf{eV}}{\mathbf{Cr}} \qquad (17)$$

establish the existence of space around it are two types of magnetic fields - vector **H** ⊥ and scalar **H** ‖ [22, 73]

$$\mathbf{H}_{\perp} = \mathrm{rot}\,\mathbf{A}, \qquad (18)$$

$$\mathbf{H}_{\parallel} = -\,\mathrm{div}\,\mathbf{A}. \qquad (19)$$

In determining the resultant magnetic field vector **H** ° ⊥ = ROT **A** $_0$ on the length of the line current, the direction of the field vector **H** ⊥ determined by the position of the observation point **N** to the right or left of the direction of the current in the interval, and is independent of the direction of the current in it in the direction to the observation point **N** or from it. When determining the same result scalar magnetic field **H** ° ‖ -div = **A** $_0$ on the length of the line current sign of the field **H** ° ‖ , on the contrary, does not depend on the position of the observation point to the right or left of the direction of the current in the interval, but it depends on the direction of the current in it in the direction to the observation point **N** or from it. If the current segment further changes also its direction by 90 ° with respect to the original, then the sign of the scalar magnetic field **H** ° ‖ changes again. With these features resulting scalar magnetic field **H** ° ‖ around any closed (e.g. rectangular) loop equals zero only in the planes, each of which passes through the center side of the rectangular outline and perpendicular to it. At the corners as its resultant scalar magnetic field **H** ° ‖ has a maximum value

$$\mathbf{H}_{\parallel макс} = \mathbf{H}_{\parallel 1} + \mathbf{H}_{\parallel 2} + \mathbf{H}_{\parallel 3} + \mathbf{H}_{\parallel 4} \neq 0\,, \qquad (20)$$

determining occurrence of so-called "corner effect" dynamic interaction, for example, other circuit elements with currents (see. describe experiments 4, 13, 20, 21, 25-28).

9. Found a complete functional relationship of the electric field **E** $_0$ of the moving charge with two types of magnetic fields induced by them

$$\mathbf{H}_{\perp} = \frac{1}{\mathbf{C}}\left[\mathbf{V} \times \mathbf{E}_{\mathbf{o}}\right], \qquad (21)$$

$$\mathbf{H}_{\parallel} = \frac{1}{\mathbf{C}}\left(\mathbf{V} \cdot \mathbf{E}_{\mathbf{o}}\right). \qquad (22)$$

10. established functional relationship to the total magnetic interaction arbitrarily moving charges e $_1$ and e $_2$ [15]

$$\mathbf{F} = \frac{\mathbf{e}_1}{\mathbf{C}}\left[\mathbf{V}_1 \times \mathbf{H}_{\perp 2}\right] + \frac{\mathbf{e}_1}{\mathbf{C}}\left(\mathbf{V}_1 \cdot \mathbf{H}_{\parallel 2}\right), \qquad (23)$$

according to which the magnetic interaction between parallel moving charges e_1 and e_2 is determined depending on the potential part (23)

$$\mathbf{F}^{\parallel} = \frac{e_1 e_2}{C^2 r^3}(\mathbf{V}_1 \cdot \mathbf{V}_2)\mathbf{r}, \tag{24}$$

while the perpendicular magnetic interaction of moving charges e_1 and e_2 is determined by non-potential part of the dependence (23)

$$\mathbf{F}_{12}^{\perp} = \frac{e_1 e_2}{C^2 r^3}\mathbf{V}_2(\mathbf{V}_1 \cdot \mathbf{r}) + \frac{e_1 e_2}{C^2 r^3}\mathbf{V}_1(\mathbf{V}_2 \cdot \mathbf{r}), \tag{25}$$

$$\mathbf{F}_{21}^{\perp} = \frac{e_1 e_2}{C^2 r^3}\mathbf{V}_1(\mathbf{V}_2 \cdot \mathbf{r}) + \frac{e_1 e_2}{C^2 r^3}\mathbf{V}_2(\mathbf{V}_1 \cdot \mathbf{r}), \tag{26}$$

and

$$\mathbf{F}_{12}^{\perp} = -\mathbf{F}_{21}^{\perp}. \tag{27}$$

Dependence (23) - (26), as opposed to the Lorentz formulas and Ampere, not inconsistent with the third law of mechanics, in agreement with experimental observations and establish the existence of a previously unknown phenomenon of longitudinal magnetic interaction.

11. According to (13), (14), (18), (19), (21) and (22) for the total energy of the magnetic field $\mathbf{H}^{\perp}$ and $\mathbf{H}^{\parallel}$ moving charges e_1 and e_2 can be written

$$W_H^{o} = \frac{1}{8\pi}\int_V H_{n_1}^2 dV + \frac{2}{8\pi}\int_V \mathbf{H}_{n_1}\mathbf{H}_{n_2} dV + \frac{1}{8\pi}\int_V H_{n_2}^2 dV, \tag{28}$$

where

$$\mathbf{H}_n = |\mathbf{H}_{\perp}|\mathbf{r}_o + |\mathbf{H}_{\parallel}|\mathbf{x}_o, \tag{29}$$

that is fully equivalent to the energy $\mathbf{W}_A{}^{o}$, determined by the known dependence of the vector potential **A** [13]:

$$W_A^{o} = -\frac{1}{C}\left[\mathbf{A}_1 e_1 \mathbf{V}_1 + (\mathbf{A}_1 e_2 \mathbf{V}_{2+} \mathbf{A}_2 e_1 \mathbf{V}_1) + \mathbf{A}_2 e_2 \mathbf{V}_2\right] \tag{30}$$

Dependence (23) and (28) can easily eliminate known in electrodynamics numerous contradictions and paradoxes (see. Theoretical contradictions 7-10, 12-16, 19).

12. (28) - (30) for the total energy of the magnetic interaction $\mathbf{W}_H$ parallel to the moving charges e_1 and e_2 find

$$W_H = \frac{1}{8\pi}\int \mathbf{H}_{n_1}\,\mathbf{H}_{n_2}\,dV + \frac{1}{8\pi}\int \mathbf{H}_{n_2}\,\mathbf{H}_{n_1}\,dV\,, \tag{31}$$

which is equivalent to the interaction energy $\mathbf{W}_A$, determined by the known dependence of the vector potential **A** [13]

$$W_A = \frac{1}{C}(\mathbf{A}_1 e_2 \mathbf{V}_2 + \mathbf{A}_2 e_1 \mathbf{V}_1). \tag{32}$$

13. The force $\mathbf{F}^{\parallel}$ (24) parallel to the magnetic interaction between moving charges e_1 and e_2 can be determined as well as

$$\mathbf{F}_H = -\frac{\partial W_H}{\partial \mathbf{r}} = -\frac{e_1 e_2}{C^2 r^3}(\mathbf{V}_1 \cdot \mathbf{V}_2)\mathbf{r} \equiv \mathbf{F}^{\parallel}, \tag{33}$$

equivalent according to the known potential (see. the theoretical contradiction 12, 13, 14, 15)

$$\mathbf{F}_A = -\frac{\partial W_A}{\partial \mathbf{r}} = -\frac{e_1 e_2}{C^2 r^3}(\mathbf{V}_1 \cdot \mathbf{V}_2)\mathbf{r} \equiv \mathbf{F}^{\parallel} \equiv \mathbf{F}_H\,. \tag{34}$$

14. The existence of the gradient of the electric fields of an arbitrarily moving charge [16, 74]

$$\mathbf{a} = -\frac{V}{C}\mathrm{grad}_x|\mathbf{A}|, \tag{35}$$

$$\mathbf{b} = -\frac{V}{C}\mathrm{grad}_r|\mathbf{A}|, \tag{36}$$

$$\overline{\mathbf{A}} = -\frac{V}{C}\mathrm{grad}'_x|\mathbf{A}|, \tag{37}$$

$$\overline{\mathbf{B}} = -\frac{V}{C}\mathrm{grad}'_r|\mathbf{A}|, \tag{38}$$

determine the full force of **F** (23) of the magnetic interaction between two arbitrarily moving charges e_1 and e_2 as

$$\mathbf{F} = e_1\langle \overline{\mathbf{B}}_2\text{-}(\mathbf{a}_2+\mathbf{b}_2)\rangle + e_1\,\overline{\mathbf{A}}_2 \equiv \frac{e_1}{C}\left[\mathbf{V}_1\times\overline{\mathbf{H}}_{\perp_2}\right]+\frac{e_1}{C}(\mathbf{V}_1\cdot H_{\parallel_2}). \qquad (39)$$

From (35) - {38) is directly establish that any so-called "magnetic" interaction (including through the inner magnetic field) are, ultimately, through the interaction of the electrical field gradient that would reflect a consideration as a potential delayed and deformation of the electric fields of moving charges. However, the relation (39) for the interaction of moving electric charges through gradient electric fields **A, b, Ā, B** is considered traditional in electrodynamics scheme as an addition to the permanent Coulomb interaction between the same charges. Physics is the meaning of the electric field gradient (35) - (38) of the moving charge is that when considered in conjunction with the Coulomb electric field $\mathbf{E}_K$ of the same charge, the resulting electric field **E** of the moving charge will be no other than the usual Strain the electric field $\mathbf{E}' = \mathbf{E}_{def}$ due regard trivial effects of retarded potentials.

15. The total energy of the magnetic field $\mathbf{H}_\perp$ and $\mathbf{H}_\parallel$ moving with velocity **V** charge e of the electron is equal to [25]

$$W_\pi^o = \frac{1}{8\pi}\int\left(H_\perp^2 + H_\parallel^2\right)dV \equiv \frac{m_o V^2}{2} = W_K. \qquad (40)$$

From (40) it follows that the **mass of the electron is completely electromagnetic origin and gravitational properties of the electron (positron) is not.**

16. Installed full Lagrangian function for two interacting charged particles

$$L = W_{K_1} + W_{K_2} - \frac{e_1e_2}{r} + \frac{e_1e_2V_1V_2}{rC^2} - \frac{e_1e_2\left(V_1^2+V_2^2\right)}{2rC^2} = \qquad (41)$$
$$= W_{K_1} + W_{K_2} - W_E(r) + W_H(r,V) - W_H'(V),$$

by means of which to the law of conservation of the generalized momentum **P** find

$$\frac{dP}{dt} \equiv 0. \qquad (42)$$

Known in electrodynamics the Lagrangian supplemented member $e_1 e_2 (\mathbf{V}_1^2 + V_2^2) / 2 R \mathbf{C}^2$, which reflects a previously unconsidered nonpotential of the magnetic interaction between moving charges and is only a function of the velocity of the charge.

17. We obtain a closed loop (reflecting the physical principle of the short-range), the system of differential equations for the two types of magnetic fields $\mathbf{H}_\perp$ and $\mathbf{H}_\parallel$ moving in the physical vacuum of charge [22]

$$\operatorname{div}\mathbf{H}_{\perp}(\mathbf{r}) = 0, \tag{43}$$

$$\operatorname{rot}\mathbf{H}_{\perp}(\mathbf{r}) = \frac{4\pi}{C}\mathbf{j}_{\text{см}}(\mathbf{r}) + \frac{4\pi}{C}\mathbf{j}^{\text{п}}_{\text{см}}(\mathbf{r}), \tag{44}$$

$$-\operatorname{grad}\mathrm{H}_{\parallel}(\mathbf{r}) = \frac{4\pi}{C}\mathbf{j}_{\text{см}}(\mathbf{r}), \tag{45}$$

where

$$\mathbf{H}_{\perp}(\mathbf{r}) = \operatorname{rot}\mathbf{A}, \tag{46}$$

$$\mathrm{H}_{\parallel}(\mathbf{r}) = -\operatorname{div}\mathbf{A}. \tag{47}$$

The system of equations (43) - (47) can be easily (without the use of so-called additional conditions, calibration) reduces to the Poisson equation, the solution of which is already without the use of mathematical formalism primed coordinates and δ-function. In the case of linear segments of the current solution of the equations (43) - {45) can be easily found by a simple integration of right and left sides of the equations on the surfaces $\mathbf{S}_0$ and $\mathbf{S}_\sigma$, respectively limiting axial $\mathbf{J}_{sm\parallel}$ (15) and radial $\mathbf{J}_{sm\perp}$. (16) displacement currents.

In the particular case of an infinite linear current system of equations (43) - (47) is reduced to a system of equations for the vector magnetic field $\mathbf{H}_{\perp}$ similar known system of Maxwell's equations.

18. get [73] a complete system of differential and integral equations for the vortex electric field $\tilde{\mathbf{E}}$

$$\tilde{\mathbf{E}} = -\frac{1}{C}\frac{\partial \mathbf{A}}{\partial t} = -\frac{e\partial \mathbf{V}}{C^2 R\partial t} \tag{48}$$

rapidly moving charge e in the form

$$\mathrm{rot}\mathbf{A} = -\frac{1}{C}\frac{\partial \mathbf{H}_{\perp}}{\partial t}, \tag{49}$$

$$\mathrm{div}\mathbf{A} = \frac{1}{C}\frac{\partial \mathbf{H}_{\parallel}}{\partial t}, \tag{50}$$

$$\oint_{l} \tilde{\mathbf{E}} d\mathbf{l} = -\frac{1}{C}\frac{\partial}{\partial t}\int_{s} \mathbf{H}_{\perp} d\mathbf{S}, \tag{51}$$

$$\oint_{s} \tilde{\mathbf{E}} d\mathbf{S} = \frac{1}{C}\frac{\partial}{\partial t}\int_{v} \mathbf{H}_{\parallel} dV. \tag{52}$$

19. The relationship of the vortex electric field $\tilde{\mathbf{E}}$ (48) rapidly moving charge e with the change of the total energy $\mathbf{W}_{P}$ (40), two types of magnetic fields $\mathbf{H}_{\perp}$ and $\mathbf{H}_{\parallel}$ of the same charge [15]

$$\tilde{\mathbf{E}} = -\frac{\mathbf{V}}{4\pi\ e\mathbf{V}^2}\frac{\partial}{\partial t}\int \left(\mathbf{H}_{\perp}^2 + \mathbf{H}_{\parallel}^2\right) dV. \tag{53}$$

20. It was found that the work of **A** in its own vortex electric field $\tilde{\mathbf{E}}$ (48) accelerated to a velocity **V** charge e is equal to the total energy $\mathbf{W}_{P}$ (40) magnetic fields $\mathbf{H}_{\perp}$ and $\mathbf{H}_{\parallel}$ of charge [15]

$$A = \tilde{\mathbf{E}} e \Delta \mathbf{x} = \frac{1}{8\pi}\int \left(\mathbf{H}_{\perp}^2 + \mathbf{H}_{\parallel}^2\right) dV. \tag{54}$$

From (54) it follows that when accelerating, for example, an electron (positron) to speed **V** operation **A** (54) to accelerate the charge e is spent only on the creation of magnetic fields $\mathbf{H}_{\perp}$ and $\mathbf{H}_{\parallel}$ of the electron charge, rather than giving the so-called kinetic energy mass m_0 of the electron charge.

21. The total work $\mathbf{A}_0$ two interacting accelerated to a velocity $\mathbf{V}_1 = \mathbf{V}_2 = \mathbf{V}$ charge e_1 and e_2 in its own vortex electric fields $\tilde{\mathbf{E}}_1$ and $\tilde{\mathbf{E}}_2$ is equal to the total self-energy $\mathbf{W}_H$ (40) and the total energy **W** (31), (32) interacting magnetic fields $\mathbf{H}_{\perp}$ and $\mathbf{H}_{\parallel}$ these charges [50]

$$A_o = \tilde{\mathbf{E}}_1 e_1 \Delta \mathbf{x}_1 + \left(\tilde{\mathbf{E}}_1 e_2 \Delta \mathbf{x}_2 + \tilde{\mathbf{E}}_2 e_1 \Delta \mathbf{x}_1\right) + \tilde{\mathbf{E}}_2 e_2 \Delta \mathbf{x}_2 \equiv \mathbf{W}_H^o \equiv \mathbf{W}_A^o, \tag{55}$$

equivalent $\mathbf{W}_H{}^o$ (28) and $\mathbf{W}_A{}^o$ (30).

22. established a complete and balanced system of differential equations for the vortex of electric and magnetic fields and vortex-vortex vector potential of the electromagnetic field in the physical vacuum of real space [26, 75-77]

$$\mathrm{div}\tilde{\mathbf{H}}'_{\perp} = 0, \qquad \mathrm{div}\tilde{\mathbf{E}}' = 0, \tag{56}$$

$$\mathrm{rot}\tilde{\mathbf{H}}'_{\perp} = \frac{1}{C}\frac{\partial \tilde{\mathbf{E}}}{\partial t}, \qquad \mathrm{rot}\tilde{\mathbf{E}}' = -\frac{1}{C}\frac{\partial \tilde{\mathbf{H}}'_{\perp}}{\partial t}, \tag{57}$$

$$-\mathrm{grad}\tilde{H}'_{\parallel} = 0, \qquad -\mathrm{grad}\tilde{E}' = 0, \tag{58}$$

$$\tilde{\mathbf{H}}'_{\perp} = \mathrm{rot}\,\tilde{\mathbf{A}}', \qquad \tilde{\mathbf{E}}' = \mathrm{rot}\,\tilde{\mathbf{G}}', \tag{59}$$

$$\tilde{H}'_{\parallel} = -\mathrm{div}\,\tilde{\mathbf{A}}', \qquad \tilde{E}' = -\mathrm{div}\tilde{\mathbf{G}}', \tag{60}$$

$$\tilde{\mathbf{E}}' = -\frac{1}{C}\frac{\partial \tilde{\mathbf{A}}'}{\partial t}, \qquad \tilde{\mathbf{H}}'_{\perp} = -\frac{1}{C}\frac{\partial \tilde{\mathbf{G}}'}{\partial t}. \tag{61}$$

The system of equations (56) - (61) can be easily (without the use of so-called normalization, calibration) is reduced to the wave equation for vortex vector potentials **Ã** and **Ğ**

$$\Delta\,\tilde{\mathbf{A}}' - \frac{1}{C^2}\frac{\partial^2 \tilde{\mathbf{A}}'}{\partial t^2} = 0, \tag{62}$$

$$\Delta\,\tilde{\mathbf{G}}' - \frac{1}{C}\frac{\partial^2 \tilde{\mathbf{G}}'}{\partial t^2} = 0. \tag{63}$$

Differentiating the left and right sides of the equations (62), (63) with (59) and (60) we obtain the corresponding wave equation for the vortex magnetic $\hat{\mathbf{H}}'_{\perp}$ and $\hat{H}'$ and vortex electric $\tilde{\mathbf{E}}'$, $\tilde{E}'$ fields in the physical vacuum of real space

$$\Delta\tilde{\mathbf{H}}'_{\perp} - \frac{1}{C^2}\frac{\partial^2 \tilde{\mathbf{H}}'}{\partial t^2} = 0, \tag{64}$$

$$\Delta\tilde{H}'_{\parallel} - \frac{1}{C}\frac{\partial^2 \tilde{H}'_{\perp}}{\partial t^2} = 0, \tag{65}$$

$$\Delta\tilde{\mathbf{E}}' - \frac{1}{C^2}\frac{\partial^2 \tilde{\mathbf{E}}'}{\partial t^2} = 0, \tag{66}$$

$$\Delta\tilde{E}' - \frac{1}{C^2}\frac{\partial^2 \tilde{E}'}{\partial t^2} = 0. \tag{67}$$

23. In the framework of the formalism of the vector $\mathbf{H}_{\perp}$ = ROT **A** and scalar $\mathbf{H}_{\parallel}$ = -div **A** magnetic field the functional dependence for an infinite cyclic process of nucleation and propagation of electromagnetic waves rapidly moving charge, reflecting the physical principle of the short-range and natural causal link between the different in nature currents and different in nature electric and magnetic fields and potentials:

$$\varphi(r,t)\to|\,\mathbf{E}(r,t)\,|_{o}\Rightarrow\left(\frac{1}{4\pi}\frac{\partial \mathbf{E}}{\partial t}\right)\Rightarrow\left\langle\begin{array}{c}0=\operatorname{div}\mathbf{H}_{\perp}\\ \frac{4\pi}{C}\left(\mathbf{j}_{CM}+\mathbf{j}^{n}_{CM}\right)=\operatorname{rot}\mathbf{H}_{\perp}\\ \frac{4\pi}{C}\mathbf{j}_{CM}=-\operatorname{grad}H_{\parallel}\end{array}\right\rangle_{O}\Rightarrow\left(\frac{4\pi}{C}\mathbf{j}^{n}_{CM}=\Delta\,\mathbf{A}\right)\Rightarrow$$

$$\mathbf{A}(\mathbf{r},t)\Rightarrow\left[\begin{array}{c}\operatorname{rot}\mathbf{A}=\mathbf{H}_{\perp}\\ -\operatorname{div}\mathbf{A}=\mathbf{H}_{\parallel}\\ -\frac{1}{C}\frac{\partial \mathbf{A}}{\partial t}=\tilde{\mathbf{E}}_{o}\end{array}\right]_{o}\Rightarrow\left[\tilde{\mathbf{E}}_{o}(\mathbf{r},t)\right]_{1}\Rightarrow\left(\frac{1}{4\pi}\frac{\partial\tilde{\mathbf{E}}_{o}}{\partial t}=\tilde{\mathbf{j}}_{CM}\right)\Rightarrow\left\langle\begin{array}{c}0=\operatorname{div}\tilde{\mathbf{H}}'_{\perp}\\ \frac{4\pi}{C}\tilde{\mathbf{j}}_{CM}=\operatorname{rot}\tilde{\mathbf{H}}'_{\perp}\\ 0=-\operatorname{grad}\tilde{H}'_{\parallel}\end{array}\right\rangle$$

$$\Rightarrow\left(\frac{4\pi}{C}\tilde{\mathbf{j}}_{CM}=\Delta\,\tilde{\mathbf{A}}'\right)\Rightarrow\tilde{\mathbf{A}}'(\mathbf{r},t)\Rightarrow\left[\begin{array}{c}\operatorname{rot}\tilde{\mathbf{A}}'=\tilde{\mathbf{H}}'_{\perp}\\ -\operatorname{div}\tilde{\mathbf{A}}'=0\\ -\frac{1}{C}\frac{\partial\tilde{\mathbf{A}}'}{\partial t}=\tilde{\mathbf{E}}'\end{array}\right]_{1}\Rightarrow\left[\tilde{\mathbf{E}}'(\mathbf{r},t)\right]_{2}\Rightarrow\left(\frac{1}{4\pi}\frac{\partial\tilde{\mathbf{E}}'}{\partial t}\right.$$

$$\Rightarrow\left\langle\begin{array}{c}0=\operatorname{div}\tilde{\mathbf{H}}''_{\perp}\\ \frac{4\pi}{C}\tilde{\mathbf{j}}'_{CM}=\operatorname{rot}\tilde{\mathbf{H}}''_{\perp}\\ 0=-\operatorname{grad}\tilde{H}''_{\parallel}\end{array}\right\rangle_{2}\Rightarrow\left(\frac{4\pi}{C}\tilde{\mathbf{j}}'_{CM}=\Delta\,\tilde{\mathbf{A}}''\right)\Rightarrow\tilde{\mathbf{A}}''(\mathbf{r},t)\Rightarrow\ \text{и т.д.}\qquad(68)$$

Starting with the third cycle, eddy $\tilde{\mathbf{E}}$ '' and eddy magnetic $\hat{\mathbf{H}}$ '' and Ĥ ''fields are already fully equivalent vortex electric $\tilde{\mathbf{E}}$ ' and magnetic vortex $\hat{\mathbf{H}}$ ' , Ĥ 'previous fields of the 2nd cycle of an electromagnetic wave, which reflects the beginning of the spread of cyclic already electromagnetic wave.

24. Infinite functional dependence (68) for the process of nucleation and propagation of electromagnetic waves is, from the physical point of view, quite clear picture of causation different nature phenomena of electromagnetism, but from a mathematical point of view is very cumbersome and inconvenient for practical use . To make the relationship (68) completed the mathematical form of the wave equation (62)

is enough already repeated, starting with the second cycle, the infinite cyclic process simple loop, which requires a system of differential equations, such as the third cycle,

$$0 = \operatorname{div} \tilde{\mathbf{H}}''_{\perp}, \tag{69}$$

$$\frac{4\pi}{C} \tilde{\mathbf{j}}'_{см} = \operatorname{rot} \tilde{\mathbf{H}}''_{\perp}, \tag{70}$$

$$0 = -\operatorname{grad} \tilde{H}''_{\parallel} \tag{71}$$

instead finds the unknown magnetic fields $\hat{\mathbf{H}}_{\perp}''$, $\hat{H}_{\perp}''$, electro-magnetic field is already known to substitute the values of these fields $\hat{\mathbf{H}}_{\perp}'$, $\hat{H}_{\perp}'$, found by solving the system of equations of the previous second cycle, ie. e.

$$0 = \operatorname{div} \tilde{\mathbf{H}}'_{\perp}, \tag{72}$$

$$\frac{4\pi}{C} \tilde{\mathbf{j}}'_{см} = \operatorname{rot} \tilde{\mathbf{H}}'_{\perp}, \tag{73}$$

$$0 = -\operatorname{grad} \tilde{H}'_{\parallel}. \tag{74}$$

In view of

$$\tilde{\mathbf{j}}'_{см} = \frac{1}{4\pi} \frac{\partial \tilde{\mathbf{E}}'}{\partial t}, \tag{75}$$

$$\tilde{\mathbf{E}}' = -\frac{1}{C} \frac{\partial \tilde{\mathbf{A}}'}{\partial t}, \tag{76}$$

$$\tilde{\mathbf{H}}'_{\perp} = \operatorname{rot} \tilde{\mathbf{A}}', \tag{77}$$

$$\tilde{H}'_{\parallel} = -\operatorname{div} \tilde{\mathbf{A}}' \tag{78}$$

of looped system of differential equations (72) - (74) without the use of mathematical formalism normalization and calibration directly set

$$\Delta \tilde{\mathbf{A}}' - \frac{1}{C^2} \frac{\partial^2 \tilde{\mathbf{A}}'}{\partial t} = 0. \tag{79}$$

Thus, by conducting improving basic equations of electrodynamics eliminated serious contradictions and obtained more or less consistent with the physical and mathematical point of view, the system of differential equations of electrostatics and electrodynamics for the two types of magnetic fields seemed, could triumph! However, further research shows that the new "perfect" electrodynamics is still not perfect. First of all, the assumption of the existence of two types of magnetic fields - vector $\mathbf{H}_{\perp}$ and scalar $H_{\parallel}$, allowing many difficulties and contradictions in the experimental and theoretical issues of modern electrodynamics, in some particular cases again leads to new difficulties and contradictions. For example, when setting according to the magnetic field $\mathbf{H}_{\perp}$ and $H_{\parallel}$ through displacement currents $\mathbf{J}_{sm\perp}$ (15), $\mathbf{J}_{sm\parallel}$ (16) short-range principle is only partially used (displacement currents $\mathbf{J}_{sm\perp}$, $\mathbf{J}_{sm\parallel}$ must be determined through a given surface $\mathbf{S}_0$ and $\mathbf{S}_{\sigma}$). More serious problems are found, for example, when trying to find the magnetic interaction energy **W** between moving charges through their magnetic fields $\mathbf{H}_{\perp}$ and $H_{\parallel}$, since the physical nature remains unclear interaction vector $\mathbf{H}_{\perp}$ and scalar $H_{\parallel}$ magnetic fields between them. Finally, within the formalism of the two types of magnetic fields principal difficulty arises when trying to establish a physical relationship between the energy of the magnetic field and the polarization of the physical vacuum operation as was possible in the case of electrostatics (4) and (6). Detected difficulties forced to look for ways to further improve the equations of electrodynamics. And such are the ways of improvement is possible. Formalism of the two types of magnetic fields - vector $\mathbf{H}_{\perp}$ and scalar $H_{\parallel}$ - you can go, for example, to the formalism of one full vector magnetic field $\mathbf{H}_P$ (29). New formalism allows us to write the equations of electrodynamics in a more simple and perfect form:

$$\mathrm{rot}\mathbf{H}_n(\mathbf{r}) = 0, \tag{80}$$

$$\mathrm{div}\mathbf{H}_n(\mathbf{r}) = 4\pi\rho_o^{'}(\mathbf{r}), \tag{81}$$

$$\mathbf{H}_n(\mathbf{r}) = -\mathrm{grad}\varphi_o^{'}(\mathbf{r}), \tag{82}$$

fully equivalent to the equations of electrostatics already (8} - (10) where $\rho_o^{'}(\mathbf{r}) = \frac{V}{C}\rho_o(\mathbf{r})$ and $\varphi_o^{'}(\mathbf{r}) = \frac{V}{C}\varphi_o(\mathbf{r})$.

Obtain a complete corresponding system of differential equations and variables vortex electromagnetic fields in the physical vacuum and the appropriate functional dependence of the cyclic process of nucleation and propagation of electromagnetic waves. In pursuit of a more perfect system of equations of electrodynamics (80) - (82) The principle has been used for short-range completely. There is no difficulty in determining the magnetic interaction energy **W** (31), (32) and the total energy of the magnetic field (28), (30). However, you still can not find a functional relationship between the energy of magnetic fields **W** (28) and the work of the polarization of the physical vacuum. The latter circumstance forces turn to another formalism expressing the magnetic properties of the moving charges - a gradient electric fields (35) - (38), for which, in particular, can also be written

$$\mathbf{a}(\mathbf{r}) = -\frac{V_1 V_2}{C^2}\mathrm{grad}_x \varphi_o(\mathbf{r}), \tag{83}$$

$$\mathbf{b}(\mathbf{r}) = -\frac{V_1 V_2}{C^2}\mathrm{grad}_r \varphi_o(\mathbf{r}), \tag{84}$$

$$\overline{\mathbf{A}}(\mathbf{r}) = -\frac{V_1 V_2}{C^2}\mathrm{grad}'_x \varphi_o(\mathbf{r}), \tag{85}$$

$$\overline{\mathbf{B}}(\mathbf{r}) = -\frac{V_1 V_2}{C^2}\mathrm{grad}'_r \varphi_o(\mathbf{r}). \tag{86}$$

When you group them in gradient electric field $\mathbf{E}_{\parallel\nabla}$ and $\mathbf{E}_{\perp\nabla}$ for parallel and perpendicular to the moving charges in the form of

$$\mathbf{E}_{\parallel}^{\nabla} = (\mathbf{a} + \mathbf{b}) = -\frac{V_1 V_2}{C^2}\mathbf{E}_o, \tag{87}$$

$$\mathbf{E}_{\perp}^{\nabla} = (\overline{\mathbf{A}} + \overline{\mathbf{B}}) = -\frac{V_1 V_2}{C^2}\mathrm{grad}'\varphi_o \tag{88}$$

for the total energy of these fields $\mathbf{W}_{E\nabla}$ have already installed a direct relationship with the work of polarization of the physical vacuum

$$W_E^{\nabla} = \frac{1}{2}\int \mathbf{E}_1^{\nabla} e_{o1} d\mathbf{r}_1 + \frac{1}{2}\left(\int \mathbf{E}_1^{\nabla} e_{o2} d\mathbf{r}_2 + \int \mathbf{E}_2^{\nabla} e_{o1} d\mathbf{r}_1\right) + \frac{1}{2}\int \mathbf{E}_2^{\nabla} e_{o2} d\mathbf{r}_2, \tag{89}$$

that is fully equivalent to the energy $\mathbf{W}_{H}{}^{o}$ (28), $\mathbf{W}_{A}{}^{o}$ (30), $\mathbf{A}_0$ (54):

$$W_E^{\nabla} \equiv W_H^o \equiv$$

Thus, the way of perfection has led us, in the end, to the fact that virtually eliminated all serious contradictions are considered "finished building" modern electrodynamics, however, and at this stage can hardly be considered is the "building" of electrodynamics is completely finished. But the most surprising result was unexpected improvement conclude that for a consistent reflection of the physical nature of the laws of electromagnetism must completely abandon all notions of "magnetic field" as some independent physical entity, as the gradient electric field

$\mathbf{E}_{\parallel\nabla}$ and $\mathbf{E}_{\perp\nabla}$ by their nature are not that other than the deformed portion of the electric field of a moving charge. **A logical analysis of the current situation in electrodynamics again led us to the conclusion that in order to determine the interaction forces moving in the physical vacuum of the real space of electric charges is sufficient to consider the deformation of the electric fields of the charges due to trivial effects of retarded potentials.** After completing a very long trip around the world in the vast ocean of classical electrodynamics and successfully passed all his tricky unforeseen accidents and dangerous reefs, we, to our surprise, almost came back again to the initial "primitive", as part of modern electrodynamics, of the laws of electrical and magnetic interactions, which at the dawn of the initial concepts of electromagnetism were the physicists of the time. **One can only wonder sagacity Ampere, who warned that if in electrodynamics not abandon the notion of a "magnet" that in the future it threatens the incredible confusion in theory ...**

Therefore, ways to improve led us to the need to do, finally, the last and most important step and completely abandon the formalism of all types of magnetic fields and their analogues. The more so because of the above analysis has reviewed some of the contours of a new electro- static and dynamic electric fields. For example, if the equations for the fields $\mathbf{E}_0$ (8) - (10) and $\mathbf{H}_n$ (80) - (82) the actual physical vacuum space to combine a static electric field $\mathbf{E}_0$ to the total magnetic field vector $\mathbf{H}_n$ as a function

$$\mathbf{E}_д = \mathbf{E}_o - \mathbf{H}_п = \mathbf{E}_o (1 - V/C), \tag{91}$$

the system of differential equations of electrostatics and electrodynamics takes the compact form of the common system of differential equations for the dynamic electric field $\mathbf{E}_D$:

$$\operatorname{rot} \mathbf{E}_д = 0, \tag{92}$$

$$\operatorname{div} \mathbf{E}_д = 4\pi\rho\left(1 - \frac{V}{C}\right), \tag{93}$$

$$\mathbf{E}_д = -\operatorname{grad}\varphi_o\left(1 - \frac{V}{C}\right). \tag{94}$$

Most interesting in this system of differential equations is the fact that the static and dynamic state of the electric field $\mathbf{E}_0$ and $\mathbf{E}_D$ in this system are determined by a simple dynamic factor (1 - v / c). In a static state ($\mathbf{V} = 0$), the system of equations (92) - (94) describes the conventional electric field based charges in the same dynamic ($\mathbf{V} \neq 0$), the system of equations (92) - (94) fully defines all fields (91) moving charges. However, on the other hand, the resulting form of the dynamic electric field $\mathbf{E}_D$ (91) turns out to be pretty much the country as well as a simple multiplication of the field on a stationary or moving electric charge does not define the interaction force of this charge with a dynamic electric field $\mathbf{E}_D$. To determine the dynamic interaction forces of the electric field $\mathbf{E}_D$ with a stationary or moving electric charges are necessary additional formal mathematical operations. These circumstances suggest, perhaps, that it is necessary or further explanation of the physical nature of the dynamic electric field $\mathbf{E}_D$ (91) or search for other ways to write a formal reflection of the dynamic electric field of moving charges. As a dynamic electric field $\mathbf{E}_A$ moving charge in the same approximation, we can consider, for example, strain the electric field $\mathbf{E}'$(20) (see. p. 31).

$$E_o' = E_o \cos\varphi, \tag{95}$$

which was mentioned in the 2nd part of this review. Dynamic electric field in this form $\mathbf{E}_0'$(95) has already advantage, as it allows to determine the strength of the interaction with him resting and moving electric charges. Furthermore, the differential equations for the system dynamic electrical field $\mathbf{E}_0'$(95) in a similar recording

$$\text{rot}\,\mathbf{E}' = 0, \tag{96}$$

$$\text{div}\,\mathbf{E}' = 4\pi\rho_o\sqrt{1-\frac{V^2}{C^2}}, \tag{97}$$

$$\mathbf{E}' = -\text{grad}\varphi_o\sqrt{1-\frac{V^2}{C^2}} \tag{98}$$

has the same benefits, determining static and dynamic state of the electric field, but have a slightly different dynamic factor ($\sqrt{\mathbf{1} - \mathbf{V}^2 / \mathbf{C}^2}$). Furthermore, the expression for the energy $\mathbf{W}'_E$ dynamic electric field $\mathbf{E}'$ (95)

$$W_E' = \frac{1}{8\pi}\int E'^2 dV = \frac{1}{8\pi}\int\left(E_o\sqrt{1-V^2/C^2}\right)^2 dV = \frac{1}{8\pi}\int\left(E_o^2 - H_n^2\right)dV \tag{99}$$

revealed interesting physical nature of this field. From (99), in particular, it follows that the initial energy $\mathbf{W}_{E0}$ of the electric field of a stationary charge decreases when moving this charge, and by an amount equal to the energy just formally identify the total magnetic field $\mathbf{H}_P$. That is the real physical nature of the energy $\mathbf{W}_H$ magnetic field lies in the fact that the energy in the space around a moving charge does not appear, as it is generally assumed, and it disappears from [23]. Very useful here to recall the statement of Poincare, who noted at the time that "the characteristic feature of an electric current is that the magnetic field energy" flows "into the conductor," ie, disappears from the space surrounding the conductor. Found a number of other interesting consequences representation of the dynamic electric field $\mathbf{E}'_0$ (95). For example, if we consider the interaction of a moving electric charge q and the electric field $\mathbf{E}'_0$ (95) from based charges, given the retarded potentials and distortion of the electric field **E** of a moving charge, this interaction will be reflected dependence

$$\mathbf{F} = \mathbf{E}_o q' = \mathbf{E}_o q\sqrt{1-V^2/C^2}\,. \tag{100}$$

Taking into account the mass m and charge acquire mass acceleration W , the same dependence can be written in the form

$$E_o q\sqrt{1-V^2/C^2} = m_o w\,. \tag{101}$$

Equation (101) shows a relativistic effect of reducing the force of the moving charge interaction with the electric field $\mathbf{E}_0$ based charges. In the framework of the relativistic concepts of modern electrodynamics relation (101) is interpreted as the effect of "increasing the mass" m_0 moving charge if a radical shift from the left side to right:

$$E_o q = \frac{m_o w}{\sqrt{1 - V^2/C^2}}, \qquad (102)$$

priori assuming here that the electric field of the moving charge itself and the electric charge does not undergo any deformation. Consequently, in this case known relativistic controversial idea of "increasing the mass" m_0 moving charge to infinity when the velocity of the charge to the speed of light are replaced with more appropriate, from a physical point of view, the concepts of deformation of the electric field of a moving charge and reducing to zero the force of interaction him of external fields on the approach velocity of the charge to the speed of light. Interesting in this respect known mechanical analogy of interaction of the rotating armature rotating magnetic field of the stator in a synchronous motor. As approaching the speed of rotation of the armature and the rotational speed of the stator magnetic field strength of the torque applied to the armature decreases, approaching zero. This mechanical analogy, of course, is far from the actual physics of the interaction of a moving charge and the electric field, but it laid deep enough physical meaning of this interaction.

Such, in general, the prospects for building a more or less fully consistent electrodynamics of physical vacuum space within the real understanding of the static and dynamic electric fields, which completely eliminates the need to operate explicitly formal notions of "magnetic fields" and "magnetic flux". However, unfortunately, in practical terms about such a consistent electrodynamics can say so far only as a relatively distant prospect desired, for reflecting deep-rooted and clearly limited the modern conception of science known vector magnetic field $\mathbf{H}_\perp$ = ROT **A** , the inertia of thinking most scientists in modern science is so great that even a partial improvement of modern electrodynamics complement its obviously missing scalar magnetic field $\mathbf{H}_\parallel$ -div = **A** , easily eliminated numerous grave contradictions both in theory and in experimental observations, causing experts so sharp backlash that it is possible to doubt their sincere desire to get rid of existing in modern electrodynamics of contradictions and paradoxes. However, some experts openly deny the need for any changes rooted in electrodynamics views. Others show a clear lack of understanding of the internal contradictions and the paradoxical nature of modern methods in electrodynamics and deny the existence of it, even well-known difficulties and contradictions. As for the detected paradoxical, from the standpoint of modern ideas, the experimental results, the experts or made unsuccessful attempts to explain them within the famous and controversial Lorentz magnetic interaction forces, or only "authority" referred to the possibility to find an explanation, not even trying to find him. However, most experts bypass somehow silence the results of experimental observations, preferring discussion of theoretical issues, without departing from the scope of the known.

---

10. Nikolaev GV 1. Displacement currents and radial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep VINITI, reg. № 3487-78.

13. IE Tamm Fundamentals of the theory of electricity. - M .: Nauka, 1976. - S. 78 - 83,230,233,370,400.

15. Nikolaev GV IV. Justification of the reality of the axial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 528-79.

16. Nikolaev GV VIII. On the nature of the vortex electric field gradient moving charge. - Dep. VINITI, reg. № 5812-85.

21. Nikolaev GV II currents bias and radial magnetic field of a linear current / Ed. Zh."Proceedings of the universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 3488-78.

22. Nikolaev GV V. The system of equations for the axial (scalar) and radial (vector) magnetic fields of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2664-80.

23. Nikolaev GV The laws of mechanics and electrodynamics near-Earth space. Vol. 1. - S. 541 (R & D. - State. Register. № 74007254, B324555otU. 1974.).

24. Nikolaev GV The limits of applicability of classical and relativistic electrodynamics in near-Earth space. Vol. 2. - P. 164 (R & D. - State. Register. № 74007254, B340882 from X. 1974).

25. GV Nikolaev, Okulov BV On the inertial properties of the electrons / Ed. Zh."Math. Universities. Physics." - Tomsk, 1978. - Dep. VINITI, reg. № 4399-77.

26. Nikolaev GV XI.Electrodynamic phenomena in the motion of the charge in the physical vacuum. - Provision for deposit.

33. Nikolaev GV On the laws of electrodynamics and optics in rotating frames of reference relative to the Earth / Red. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 2911-74.

34. GV Nikolaev, Okulov BV On the exponential justify the principle of relativity / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 3064-74.

35. Nikolaev GV The paradox of Feynman and asymmetry laboratory and moving reference frames / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 1937-75.

36. Nikolaev GV Hall effect and the asymmetry of the laboratory and the moving reference frames / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 2507-75.

37. Nikolaev GV On the Limitations of classical and relativistic electrodynamics in the conditions on the surface of the Earth / Red. Zh."Math. Universities. Physics." - Tomsk, 1976. - Dep. in VNITI, reg. № 3277-75.

38. Nikolaev GV On checking the fundamental relations in the satellite / Ed. Zh."Math. Universities. Physics." - Tomsk, 1976. -Dep. VINITI, reg. № 3429-75.

50. Nikolaev GV IX.Vortex electric field is rapidly moving charge and the laws of inertia charges. - Dep. VINITI, reg. № 5813-85.

61. Nikolaev GV Optical and near-Earth space electrodynamic asymmetry // Application for opening, № 32-RT-8857 of 1975

64. Nikolaev GV Korshunov GS Spark gap // Application for invention. AS Number 913,494 by 07/21/80, the Bull. Number 10, 1982.

65. Solunin AM, Kostin AV On the effect of the potential for a toroidal solenoid. - Dep. VINITI, reg. № 7900-84.

66. Nikolaev GV Property of a moving charge to induce an axial magnetic field is a scalar // Application for opening, № 32-OT-10663 from 19.09.82g.

67. Nikolaev GV I. Problems of electrostatics empty space / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. №2417-80.

68. Nikolaev GV II. Physical vacuum of real space / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2418-80.

69. Nikolaev GV III. Questions electrostatics physical vacuum Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg №2419-80.

70. Nikolaev GV IV.The equations of electrostatics physical vakuumg real space. - Provision for deposit.

71. Nikolaev GV Electrostatics physical vacuum // Report on the meeting of the Section of Physics Moscow Society of Naturalists, "Theory and practice of experimental studies of the physical vacuum", M, May 1979.

72. Nikolaev GV III. Bias currents and axial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 592-79.

73. Nikolaev GV VI. The system of equations for vortex electric fields are uniformly and rapidly moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2665-80.

74. Nikolaev GV VII. The system of equations for the gradient of the electric fields of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2666-80.

75. Nikolaev G.V.H. The wave equation for the vortex electric and two types of vortex magnetic fields rapidly moving charge. - Dep. VINITI, reg. № 5814-85.

76. Nikolaev GV XII. The equations of electrodynamics of physical vacuum of real space. - Provision for deposit.

77. Nikolaev GV XII. Electrodynamics rapidly moving charge and emission of electromagnetic waves. - Provision for deposit.

78. Nikolaev GV Bias currents of the vacuum environment and the magnetic field of a moving charge // Report on the meeting of the physics section of Moscow Society of Naturalists, "Theory and practice of experimental studies of the physical vacuum." - M., May, 1979.

---

5. The ratio of specialists to attempts to improve the electrodynamics

The main source of the concept of a new physical theory "of electrostatics and electrodynamics of the physical vacuum of real space" were formulated by the author in his first papers on relativity theory [23, 24, 33-38], which provides a general analysis of the properties of the real near-Earth space and the gravitational field of the physical vacuum and a general analysis of the phenomena of electromagnetism in the stationary and moving relative to the Earth's surface frames. Already in these first studies in the analysis of some of the energy relations in the electrodynamics of moving charge was discovered a strange feature that equality in some equations retained only only when the energy $\mathbf{W}_H$ "of the magnetic field of the charge is determined by the total magnetic field of the form $H_P = (V / C) E$ instead of the well-known expression of $H_P = (V / C) E \sin cp$. However, only in 1975-76. author of the first conclusions were drawn about the possibility of the existence of a moving charge of another type of magnetic field $H_{\parallel} = (V / C) E \cos cp$ [25]. Somewhat later was given a complete and general physical justification of these conclusions [10, 15, 22, 72]. Most clearly the need for assuming the existence of another type of magnetic field was found in the analysis of known conflicting ideas about the properties of the bias currents moving charge and an overall comparative analysis of the many paradoxical situations in electrodynamics. For example, in the study of bias currents moving charge unexpectedly

found that only one axial component $j_{SM\parallel}$ current density vector displacement $j_{CM} = 1/4\pi \frac{\partial E}{\partial t}$ completely determines a well-known science magnetic field $\mathbf{H}_{\perp}$. The second radial component $j_{SM\perp}$ displacement current density vector j_{CM} was like at all excessive. One could, of course, not to focus attention on this strange circumstance identify and simply ignore the role of the radial component $j_{SM\perp}$ displacement current density vector j_{SM}, the more that one axial component $j_{SM\parallel}$ this vector already fully identified themselves known to science magnetic field $\mathbf{H}_{\perp}$. However, on the other hand, without the radial component $j_{SM\perp}$ meaningless integrity of the physical representation of the vector displacement current density j_{CM} than doubted the correctness of the recording of some famous equations of electrodynamics. Studies show [10, 21, 72] that the logical way out of The paradoxical situation is a trivial consequence. If one component $j_{SM\parallel}$ displacement current density vector j_{SM} causes a conventional induction of the magnetic field

$$\mathbf{H}_{\perp} = (V / C)\, E \sin \varphi$$

then the other components of the same vector $j_{SM\perp}$ _ should determine an induction of another type of magnetic field

$$\mathbf{H}_{\parallel} = (V / C)\, E \cos \varphi$$

Consequently, the magnetic properties of a full displacement currents can be described only in view of the existence of two kinds of magnetic fields, rather than one. The correctness of this conclusion was found immediately, as soon as the second magnetic field $\mathbf{H}_{\parallel}$ been taken into account in the analysis of many paradoxical situations in electrodynamics, described, for example, in the 3rd and 4th parts of this review. At the end of 1979 to the theoretical constructs, author obtained a complete system of differential and integral equations of electrodynamics for the two types of magnetic fields $\mathbf{H}_{\perp} = \mathrm{ROT}\, \mathbf{A}$ and $\mathbf{H}_{\parallel} - \mathrm{div} = \mathbf{A}$ [22].

In this first stage, before staging the author verification experiments have been numerous open discussions of new concepts developed by the author of electrodynamics in Tomsk, Novosibirsk, Kiev, Moscow. In theoretical terms objections specialists were reduced mainly to general discussions on the possibility to explain the many contradictions and paradoxes of electrodynamics within the known concepts, but without attempting to provide any concrete evidence of its claims. With amazing perseverance experts tried not to notice the integrity and completeness of the proposed electromagnetic theory of two types of magnetic fields and its significant advantages over the known and largely contradictory theory. For an overview of the variety of approaches to the problem of improving specialists electrodynamics and the merits of their objections below are typical statements author of experts on the proposed new approach to electrodynamics, which took place before the setting of test experiments.

1. *"At first glance, the radial component of the current should lead to the emergence of the longitudinal component of the magnetic field, but the axial symmetry of the total longitudinal field is zero."*

Here reviewer mistakenly brings the usual representation of the famous cross (distribution in space) magnetic field vector to represent the unknown in science longitudinal (distribution in space) of the scalar magnetic field.

"With regard to the interaction of moving charges with the vector and scalar magnetic fields, then compare the elementary currents moving charges, as does the author, it is impossible, at least because the latter are characterized by the presence of primarily electric fields" (TSU, Tomsk).

According to the reviewer, taking into account the interaction between fields and charges not allowed to take into account "separate magnetic interaction force with no electric" than being questioned known principle of superposition applies to the considered electric and magnetic fields. Objection reviewer based, obviously, on the erroneous belief in the opportunity to resolve the paradoxes in the magnetic interaction of moving elementary charges in the case of a simple account of the electric forces of interaction between them.

2. *"For such a radical change in the modern physical picture of the world need a very good reason, we need serious scientific evidence substantiated the advantages of the proposed theory to time-tested and most importantly, the practice of relativistic electrodynamics"* (TSU, Tomsk).

According to the reviewer, the evidence (see. Theoretical contradictions in the 4th part of the review) is still not enough to shake the "time-tested" relativistic electrodynamics.

3. *"Violation of the third law of mechanics, electrodynamics is well known, but the existence of a scalar magnetic field is unacceptable, since the introduction of this field in the equations of electrodynamics will make them non-invariant with all its consequences for the whole relativistic electrodynamics"* (TSU, Tomsk).

Reviewer (author of many works on the relativistic theory!) Is an ardent supporter of relativism and formal mathematical methods in physics, with all the ensuing consequences for the contradictory and paradoxical electrodynamics and explicit formalism in the reflection of reality of the physical world. As for the non-invariance of the equations of electrodynamics, it is not so much due to the assumption of the existence of scalar magnetic field as the assumption of the reality of the physical vacuum environment and taking into account the existence of trivial effects retarded potentials and distortion of the electric field of a moving charge. **Full invariance of the equations of electrodynamics is valid only in a totally empty space unreal STO . In free space, the SRT is unacceptable existence of any environment, since it immediately asimmetriruet any real phenomenon, which has repeatedly been pointed out by Einstein, the author of this theory.** Detectable is now different properties of the physical vacuum fully characterize him already as a real physical environment.

4. *"The presence of the scalar magnetic field generates forces acting on the charge towards the speed of the charge. But then follows trivially self-acceleration of the charge in such fields. And it is not clear why there is still no one accelerator of the world, this effect was not found." "In science, it so happens that all wrong, but only one person is right. However, it is certainly not the case and my categorical* (a negative attitude to work. - **GN**) *is justified. "* (TSU, Tomsk).

When it comes to self-acceleration of the charge, the reviewer mistakenly believe that their own inner magnetic field can accelerate the charge (similar, for example, in their own vector magnetic field to bend its trajectory). As for the acceleration of charged particles in external scalar magnetic fields of other charges, for the implementation of such an acceleration structure of modern accelerators is simply

not adapted. Nevertheless, the phenomenon of longitudinal magnetic interaction is definitely present in modern accelerators in the form of various kinds of collateral "adverse effects", causing largely known effects of longitudinal instability of accelerated charged particles. An example of this is spurious "edge effects" induction-aligned currents in the conductive medium in the MHD generator.

5. *"If the longitudinal magnetic force existed, it would have been discovered long ago in numerous laboratory studies."* (TPU, Tomsk)

Hope for a "case" in science, of course, you can, but in this case it is necessary, even remotely foresee and to have at least basic information about the nature of the expected power: where, how and in what cases it can occur. You must also take into account that detect prohibited dominant force theory is not easy!

6. *"The author completely eliminates the principle of action at a distance, which is contrary to, in particular, the law of universal gravitation. introduced by the author in the same concept of scalar magnetic field with the experimental data. Correction of Maxwell's equations is ungrounded. In general proposals have no scientific or practical value"* . (OOF USSR Academy of Sciences)

Leaving on the conscience of the expert group in the assumption of the principle of long-range gravity submitted review reflects a total negation of its authors as available in the electrodynamics of difficulties and contradictions, and the need for any development of advanced theory.

The above objections experts reflect, on the one hand, quite the opposite point of view of each of them on the same subject matter, but on the other hand, is very repetitive and explicit attempts to leave everything in the modern electrodynamics unchanged. However, these objections reflect only a certain extent biased negative approach of a number of specialists to the improvement of modern electrodynamics. In contrast, some experts expressed a fairly complete understanding of the serious contradictions known methods of modern electrodynamics and the need to improve them. Very close to the point of view of the author expressed in his work [9] KS Demirchian. The author of this work is a staunch supporter of the principle of a short in electrodynamics and believes that a correct description of magnetic fields is possible only through some bias currents, since only thus can obtain the correct form of differential equations for the point. In turn, this avoids the well-known difficulties in identifying the physical nature of the equations of electrodynamics. A number of experts (Tomsk, Novosibirsk, Kiev) expressed approval of the need to improve the well-known mathematical methods of electrodynamics, as due to excessive formalities are significant difficulties in their practical use. Critical attitude to the equations of electrodynamics expressed mainly by practitioners who constantly have to deal with the use of these equations to solve various practical problems. From their comments that they have long been convinced of the significant limitations of Maxwell's equations in their conventional recording and for their specific practical problems they use their semi-empirical calculation methods (Novocherkassk). During the debate discussed various strange experimental results explanation that in the framework of the known concepts can not be found. However, recognizing the overall unsatisfactory condition in modern electrodynamics, specialists exercise some caution when evaluating various theories. In identifying specific ways to improve electrodynamics some theoretical evidence are still insufficient. Therefore, in early 1982, after a 5-, 6- year period of testing the theoretical part of the work, the author was given a series of targeted experiments to detect the phenomena predicted by the longitudinal magnetic interaction. The results of the experiments, as was to be expected, were in full agreement as to the general theoretical conclusions, as well as with the basic laws of mechanics. In particular, it has been found that the interaction, such as a current perpendicular to the transverse force components $F_{\perp}$

Lorentz acting on some segments of current in full accordance with the third law of mechanics, compared with the equal and opposite longitudinal forces of reaction $F_{\parallel}$, attached to the other current segments, and vice versa. And yet, even in the presence of experimental evidence for the existence of another type of longitudinal magnetic interaction, even full compliance with the laws of mechanics, taking into account of another type of magnetic interaction - all this is not enough to shake the established notions of supporters of modern methods in electrodynamics. For a visual representation of the essence of objections of some of these experts below are their statements both on theoretical and experimental part of the work.

7. *"This example illustrating the paradox of power interaction of current-carrying conductors, is not a good proof or even an illustration of what is offered by the author. The fact that we are considering the force interaction of limited length of conductors with a current that is an abstraction and does not occur in practice . This consideration leads to a violation of the fundamental principle of the closure of an electric current. In practice, there is always the interaction of current circuit "* (VNIIEM, Moscow).

Conclusions reviewers based on an erroneous view that under the assumption of a violation of the third law of mechanics in the magnetic interaction of the elements of the current possible elimination of these contradictions in the transition to the total result of the interaction of all these elements of closed contours. Assuming the feasibility of the superposition principle for magnetic fields and interactions of such a view is obviously incorrect. It is known that the total result of interaction with other closed contour in practical terms is defined by the interaction of the magnetic field resulting from all sides with a current contour with each of the sides of the other current circuit. And since the principle of superposition to the fields, the total result of the interaction of closed contours can always be represented as an equivalent amount of interaction between each pair of sides of these circuits, magnetic interactions in which contradictions remain. Interpretation of the results of the experiments the author of numerous reviewers is given.

8. *"The claims of the author at the opening of" previously unknown to science phenomena "unfounded and connected, apparently, with the ignorance of the fact that" within the study of closed currents constant current strength of the interaction elements can not be determined unambiguously "* (ENIN, Moscow) .

Reviewer focuses seemingly full of meaninglessness author's conclusions regarding the existence of another type of magnetic interaction. However, contrary to his wishes, from this "reasoned" argument, it follows directly that the modern electromagnetic theory in general is not able to identify the unique strength of the interaction between the two, even, for example, a simple rectangular contours of constant current. Unfortunately, these arguments reviewer largely true, if we take into account that the strength of the interaction between the circuits can be determined by different methods (via the Lorentz force, through the interaction energy of the magnetic field contours, through the energy of interaction of the elements of the current path with the vector potential of the other), which in some cases lead to obviously different results. Interpretation of the results of the experiments reviewer is given.

9. *"The problem of determining the interaction of currents is divided into two ...: a) determining the magnetic field of arbitrary power, and b) determining the forces operating in a given magnetic field to accommodate the current* (see. IE Tamm. Fundamentals of the theory of electricity) *In accordance this principle is no violation of the third law of mechanics for direct currents not, including devices for so-called "railgun type." The apparent violation of*

his due only to the determination of the forces of interaction of currents as the pairwise interaction of their elements, and not just as an action of a magnetic field currents " (IE Ukrainian Academy of Sciences, Kiev).

If we stick to the proposed reviewers principle, the U-shaped frame in the experience of Ampere (see. Experiment 1) is set in motion due to its interaction with the total magnetic field contour t. e. including its own magnetic field with a U-shaped frame, which is unacceptable by the laws of mechanics. Proposed "principle" can not in principle be used to explain the results of the experiments 2, 3, 9, 12, 13, 29-34, 36, and does not solve the contradictions closed contours in conjunction with one another (see. 4 experiments, 13,21, 27, 28-35).

10. *"Violations of Newton's third law is not - it is only for the current elements* (so what?) - *it is necessary to read Tamm. The author does not bother to prove that eliminates detected violation of the law "* (ABI, dep. Toe, Leningrad).

Due to the biased approach reviewer can not understand the fact that the assumption of a violation of the third law of mechanics in the magnetic interaction of microscopic (perpendicular) determines a current elements, in full compliance with the principle of superposition, the need for the same violations in the case of macroscopic perpendicular contour elements (see . Experiments 1-3, 5-21, 37-40, 43-48) and movable elements one with the other closed loop circuits (see. Experiments 4, 13, 20, 21, 25, 26, 32, 47, 48).

11. *"The essence of the existence of" axial field " **H** at the moving charge has a longitudinal field **H** , but not on the axis of motion. If you open "scalar magnetic field", then it is no magnetic field, as the present magnetic field is determined by the power Lorenz "* (ABI, dep. Toe, Leningrad).

The definition of "the present magnetic field" reviewer compares only with a certain transverse Lorentz force, which reflects an incomplete understanding of the properties of the "real magnetic field." Meanwhile, as a full account of the properties of the "real magnetic field" (see. Theoretical contradictions 14, 15) immediately reveals the existence of another longitudinal magnetic interaction force, significantly different from the Lorentz force. Paradoxically, but you can credibly claim that "the present magnetic field" is partly determined also through the longitudinal strength of the magnetic interaction.

12. *"apparent violation Newton's third law of interaction moving charges velocities perpendicular to each other (one of the charges is affected by the magnetic field of the other at the moment when the other is at the point where the first magnetic field is zero) arises due incorrect calculation of the forces acting on the charges. The author forgets that the magnetic field - relativistic object in the calculation of his need to take into account changes in the field, depending on the speed. We consider the problem can best be going to the coordinate system, where one of the charges at rest. In this system, he does not create a magnetic field and the external field it does not work (because the charge is at rest). Therefore, between the charges will only be effective electric field (of course, modified according to the Lorentz transformation), but - in full agreement with the mechanics - and equal oppositely directed "* (the editorial board of the journal "Nature").

Apart from the fact that the point of view of the reviewer disagrees with the known concepts of reality violation of the third law of mechanics with perpendicular magnetic interaction between the elements of the current (see. N. 3, 10), the reviewer trying to wishful thinking, believing it possible to get rid of this disorder using relativistic methods . However, even assuming applicability of formal (but symmetrical) Lorentz transformation to electric and magnetic fields perpendicular to the moving charges, then the apparent differences in the initial magnetic fields $H_1 = 0$, $N_2 = 0$ in the second charge e_2 , located on the first path, of magnetic fields in the first charge e_2 ($H_1 = 0$, $H_2 \neq 0$) immediately followed by the appearance of new contradictions. But the situation is further complicated by the fact that the Lorentz transformations for the fields in this case, when the initial magnetic field of the charges specified in the third stationary system, are in principle no longer applies, since the perpendicular motion of charges relative velocity between them is already a non-linear dependence of the form

$$V_m = \sqrt{V_1^2 + V_2^2} \quad .$$

13. *"The author offers, besides the usual vector field* $H_{\perp}$ = ROT A *, enter the field* $H_{\parallel}$ -div = A . *This operation violates covariance, t. e. is not compatible with Lorentz invariance. In fact, it is generally pointless, t. To. gauge transformation* **A** '= **A** + ∇ip *is always possible to make* ROT **A** ' = 0 *"* (the editorial board of the journal "Nature").

Formal presentation of the reviewer about the ambiguity of the field vector potential does not correspond to the unambiguous experimental results in the experience of the Aharonov-Bohm effect [17-20] and unambiguous results in experiments 13, 27-34, 39, 40. The interpretation of the results of the experiments reviewer is given.

14. *"By adding these axioms* (Coulomb's law, the Lorentz force, the principle of superposition) *Lorentz transformations for four-coordinate and momentum-energy, we arrive at the Lorentz transformation for fields that do not lead to an expression for the scalar magnetic field of the moving charge. And no tricks within classical electrodynamics it is impossible to obtain. Introduction by the author bias currents does not change anything, and under the right calculations he would have to make sure that there are no open their field "* (NSU, Novosibirsk).

The arguments of these reviewers are indicative naked in the reflection of the mathematical formalism of modern methods in electrodynamics, when the reality of the unknown field is not justified by the results of the analysis of the physical foundations of the modern theory of electromagnetism and their changes (see. Theoretical contradictions 1-21), but only a reference to the investigation into the applicability formalism of relativistic transformations, but only in the framework of known concepts and obviously known fields. Reviewers allegations about alleged they "wrong" computing bias currents no less formalism reflect their approach.

15. *"For a long time, and it is well known that there is no conflict between Newton's third law and Ampere's law for the segments of conductors* (ie moving charged particles!) *does not exist - in a system of charged particles is conserved total momentum of particles and electromagnetic field (see. I. Tamm), this is the "implementation of Newton's third law" for current-carrying conductors. These issues are discussed in detail in the classic textbook, but they need to be read carefully "* (NSU, Novosibirsk).

This view reflects the reviewers rooted misconceptions about the possibility of resolving contradictions through responsiveness of electromagnetic radiation (See below. N. 16). In the particular case of uniform and rectilinear motion of interacting charges electromagnetic radiation is absent, and conflict with the laws of mechanics remain.

16. *"Violation of the principle of equality of action and reaction to current elements mentioned in many of the fundamental work on the theory of electricity. However, in the case of direct current is necessarily closed, it is a violation of Newton's third law is only associated with the representation of the interaction forces currents as the pairwise interaction of their elements . The forces of interaction of two closed contours satisfy the principle of equality of action and reaction. "*

"In general, the alternating electromagnetic field ... prove a generalization of the law of conservation of total (mechanical and electromagnetic) momentum Since the law of conservation of momentum is equivalent to the law of action and reaction, by the same token ... and proved the validity of this last law in its generalized form (see. Tamm) " (IE Ukrainian Academy of Sciences, Kiev).

Violation of the principle of equality of action and reaction in the pairwise interaction of elements current in terms of the reviewers, it is quite possible for the modern theory of electromagnetism.

Satisfaction of the same principle of action and reaction in the case of the interaction of closed loops, as studies show, based on the assumption that the action on some elements of the first circuit without opposition to another circuit compensated effect on other elements of the second circuit without resistance at first. As a result of these assumptions, the real strength of the interaction between the closed circuits is low. Consequently, the implementation of the third law of mechanics in the magnetic interaction between the closed loops within the well-known concepts in electrodynamics, is achieved not by eliminating certain contradictions for the interaction forces between some elements of the circuit, but only due to the compensation of the same contradictions for the interaction forces between the other elements of the same circuits.

Studies show that the proof of the generalized law, the only potential functions (see. (24) 5th part of the review) magnetic interaction, reflecting a just a special case of the magnetic interaction of parallel current elements (see. Theoretical contradictions 12-15) obviously satisfies the third law of mechanics. Not to mention the fact that in this case the output density of ponderomotive forces in the magnetic field is not sufficiently correct, because it does not take into account the interaction of the elements of the current perpendicular (see. (25), (26) the 5th part of the review). The use of potential functions already allows for the possibility of existence of the phenomenon of longitudinal magnetic interaction between the elements of the current system, when they are on the same line. In addition, in the general case of non-stationary electric and magnetic fields in the proof of the generalized stress tensor T formally allowed as a superposition of the stress tensor in a stationary electric and magnetic fields, which obviously excludes consideration of the reaction of alternating electromagnetic fields interacting elements of current, including the perpendicular elements. In consideration of the case of accelerated charges alternating electromagnetic field of the radiation from these charges cause the appearance of another reaction forces, but these forces are applied, especially those charges that produce these magnetic fields, which are acted upon by the accelerating forces other charges. Meanwhile, other charges which have the force action on the radiating charge without an equivalent counter on their part (in the case of interaction perpendicular to the moving charges), the forces of reaction from radiation are substantially independent.

17. *"The author proceeds from the wrong position, considering the strong interaction between current elements as physically real, why does not notice that the process of checking formulas chosen by him (see., eg, theoretical contradictions 12-15) is not correct.*

Certainly questionable are the author's and the existence of forces (ponderomotive), longitudinal with respect to the current, as well as on its work to the alleged experiments " (the editorial board of the journal "Proceedings of the universities. Electromechanics").

Reviewers doubt the correctness of the chosen method of checking the author of the formulas for the force interaction current elements is easy to check if a quantitative calculation. Beliefs as reviewers of the impossibility of finding those experimental results that were actually observable, is very revealing in reflection of the degree of conservatism in this matter.

18. *"The experiments carried out by the author, in no way can not be used to criticize the known locations of electrodynamics and do not require to explain the observed results of the introduction of any new laws"* (ENIN, Moscow).

That's all that was said a reviewer after his acquaintance with the theory and the results of numerous experimental observations. His explanations of the experiments the reviewer does not.

19. *"impermissible explanation of the interaction of only longitudinal. It is necessary to watch that is made in cells: there is a current transverse components, and they define the whole thing"* (ABI, dep. Toe, Leningrad).

According to the reviewer, the presence of cross-currents in the fluid causes the appearance of the forces acting on the fluid is not as it should be assumed, and the longitudinal current in moving conductors. Moreover, from experiments 9-13, 31 shows that the fluid currents in the transverse forces act to displace fluid in a direction opposite to the movement of the movable conductor observed partially inhibiting its movement.

20. *"There is no doubt that in the analysis of experimental results (find out why mixing wires along its axis) missed some effects that allow to give an explanation in the" known "laws of electrodynamics. For example, in the experiment (see. 4, 20, 21 review) movement along the axis of the conductors can be explained by electrostatic ponderomotive forces (proportional to the square of the electric field) acting between the ends of the conductors. All voltage or a significant part in this experiment falls to the electrolyte. Unfortunately, the description of the experiment does not contain complete information to evaluate the possible effects "* (NSU, Novosibirsk).

Trying to explain the experiments within the known concepts, reviewers are ready to consider any secondary and side effects, while ignoring the obvious, in the framework of the known concepts, force $F_{\perp}$ the magnetic field of the current conductors moving currents transverse conductors fixed contours. Equal and opposite to those forces trivial reaction force, if not to question the validity of the third law of mechanics, electrodynamics, are directed precisely along the axis of the movable conductors and so on. D.

These are, in general terms, arguments and objections experts who doubt the need for any additions or improvements in modern methods of electrodynamics. However, the arguments made by the authority of experts, as a rule, never brought to the detailed theoretical calculations, establishing at least close their credibility. And it is not surprising if we take into account that even for a long time known in the physics of electromagnetic paradoxes in the literature, there are no reasonable quantitative explanation, which would eliminate their paradoxical nature. From the above analysis it is clear that within the known concepts correct theoretical calculations, showing the possibility of eliminating the paradoxical situation in electrodynamics, in principle, can not be obtained without significant changes rooted in electrodynamics views. It is for this reason that many paradoxes in electrodynamics already have their own history, overgrown, as they say, a big "beard", t. E. Various unsuccessful attempts rethinking and resolve them. To many in the past paradoxes in electrodynamics were a kind of touchstone in the knowledge of the actual physical nature of electromagnetic phenomena. These paradoxes have not lost their interest to researchers and inquisitive now [88-93]. However, instead of rethinking and resolve contradictions and paradoxes in the electrodynamics of some of the very conservative-minded professionals electrodynamics, including prominent doctors of science, make every effort to fully discredit new emerging trends in electrodynamics up to appeal to the journal editors not to publish the recommendations of these materials (as was done, for example, one of the members of the editorial board of a prominent magazine "Physics. Proceedings of the universities"). Unable to give a reasoned objection, they simply prevented the possibility of a broad discussion of the results. In their opinion, the situation in modern electrodynamics is quite satisfactory and publication of materials that break down entrenched in electrodynamics representation "can cause serious harm to the state."

At the present time, in an age of scientific and technological progress, identify any prospects for the development of new directions in science and technology, it would seem, without delay, should be subjected to careful scrutiny by a broad discussion of scientific discussions and publications. However, in reality, are found all sorts of difficulties in organizing such is collegial discussions. And if and where such discussions were organized, they were organized, mainly on the initiative of the authors of the new emerging trends, which indicates a certain inertia specialists to perceive any fundamentally new ideas in science. The manifestation of this inertia, many specialists can hardly be surprising if we take into account that in many popular and scientific publications strenuously promoted the view that the basic tenets of modern science in all its areas are, in general, already fully completed form. Well, if so, to open something new is possible only on the basis of already well-known and well-established scientific principles with some, such as slight their new addition. This may explain the unsuccessful attempts of some to find theoretical explanations paradoxical experimental results only in the famous deep-rooted beliefs and relentless pursuit to leave them in the modern electrodynamics all unchanged. Relating to "paradoxical" experimental facts practitioners is somewhat different. Of great interest they aroused by the sponsor construction of new devices, the principle of which is based on a previously unknown to science longitudinal magnetic forces. Some of these designs are protected by copyright certificates. Efficiency of the device is confirmed by numerous experiments and models. Materials promising applications for inventions [62-64, 91-100] discussed at the Research Institute for scientific seminars. For example, the discussion of the application materials to the device of a new type of unipolar generator for scalar magnetic fields were devoted to seminars at the Research Institute of Kharkov (experimental laboratory ENIN) and Moscow (ENIN, Experimental Station ICT USSR). The general opinion of practitioners reduced, in general, to the fact that we should not wait for the time when experts theorists finally be able to agree which magnetic forces - new or old - are in the devices and how they should be called, and now it is necessary to carry out more serious experimental study of new prospects opened in electrodynamics. Specialists theorists, however, continued to insist on the need to find explanations for the observed experimental phenomena in the ordinary standard representations.

According to them, breaking rooted in electrodynamics ideas - a very high price eliminate detected in electrodynamics minor, in their view, contradictions and paradoxes, and that it should still try to find their usual explanation. The emphasis is mainly on the identified author of the recent "paradoxical" experimental results, although a much larger number of well-known and less severe remain unexplained in electrodynamics and simply indulge already forgotten. Analyzing sociological basis for the development of new ideas in science in our time, a Polish sociologist Zbigniew Bolnar (1975) writes that *"... the scientists in our time with great tenacity defending established schemes, dissociating himself from the all new"* . More specifically stated on this occasion Thomas Kuhn, who writes that *"... the most striking feature of the problems of normal science is in how small a degree of it is committed to getting anything really new in the theoretical field and in research"* . It is appropriate to recall here a statement Tsiolkovsky, who wrote: *"They laughed and denied a lot. It's easy and nice. But what a shame and now lies on the humanity that was choking great, beaten and destroyed what later turned out to blagodatelno for himself . When we get rid of contemporaries, from this fatal defect to us. "* With regard to the words of Tsiolkovsky similar situation to some extent takes place at the moment and on the recognition in the electrodynamics of the second type of magnetic field.

Many experts, who from the very beginning categorically denied the possibility of the existence of a second magnetic field and opposed any changes in electrodynamics, is now forced to reconsider its position. Experts who first denied the possibility of the existence of longitudinal magnetic forces and refused even to discuss on this topic later secretly begin to repeat the experiments in which these forces do show up.

In recent years, interest in the problem of the vector potential and the second magnetic field has increased significantly. In 1972 was published theoretical work Solunina AM (ISU, Ivanovo) [79].

Meaning proposed by the author summarize the equations of electrodynamics in tensor terms, lay in the fact that, contrary to established notions, proposes to abandon the conditions Lorentz calibration field potentials. The author's idea was bold enough, but the realization of it were not sufficiently substantiated. As known in the electrodynamics of Maxwell's equations of the form

$$\partial_\alpha F^{\alpha\beta} = -\frac{4\pi}{C} j^\beta \qquad (103)$$

left part just introduced an additional compensating term $\partial^{\text{beta}} \partial_\sigma A^{\text{alpha}}$, ie

$$\partial_\alpha F^{\alpha\beta} + \partial^\beta \partial_\alpha A^\alpha = \frac{4\pi}{C} j^\beta \ . \qquad (104)$$

However, in such a recording, as it is obvious, one of the equations (103), (104) is clearly unequal. Nevertheless, from the generalization of the equations of motion of a charged particle in an electromagnetic field for the interaction force moving charge e with the magnetic fields produced by the author dependence

$$\mathbf{F} = \frac{e}{C}[\mathbf{V} \times \mathrm{rot}\,\mathbf{A}] + \frac{e}{C}\mathbf{V} \cdot \mathrm{div}\,\mathbf{A}, \qquad (105)$$

which obviously is already included and the second spatial derivative of the vector potential **A** . Nevertheless, excessive mathematization not quite correct assumptions are not allowed the author to understand the physical nature he received dependence which is fully consistent with the dependence (23) 4th part of this review.

In 1976 Sinel'nikov EM and Sinel'nikov DE (Novocherkassk) to resolve the contradictions in the law of force interaction of the elements of the current relationship has been proposed [29]

$$\mathbf{F} = -\frac{J_1 J_2}{C^2 r^3}(d\mathbf{l}_2\, d\mathbf{l}_2)\mathbf{r}, \qquad (106)$$

which reflects only a potential part of the formula (23) 4th part of the review. Equation (106) excluded the possibility of interaction between elements perpendicular to the current, which is clearly inconsistent with the experimental observations. However, on the other hand, the (106) directly follows the possible existence of magnetic force directed along the direction of the current. The limitations of the formula (106), apparently forced the authors to propose in 1978 has a new formula [30]:

$$\mathbf{F} = \frac{J_1 J_2}{C^2 r^3}\left\langle -2(d\mathbf{l}_1\, d\mathbf{l}_2)\mathbf{r} - \frac{3}{r^2}(d\mathbf{l}_1\, \mathbf{r})(d\mathbf{l}_2\, \mathbf{r})\mathbf{r} - d\mathbf{l}_1(d\mathbf{l}_2\, \mathbf{r}) - d\mathbf{l}_2(d\mathbf{l}_1\, \mathbf{r})\right\rangle, \qquad (107)$$

which is a formula Ampere [27]

$$\mathbf{F} = \frac{J_1 J_2}{Cr^3}\left\langle -2(d\mathbf{l}_1\, d\mathbf{l}_2)\mathbf{r} + \frac{3}{r^2}(d\mathbf{l}_1\, \mathbf{r})(d\mathbf{l}_2\, \mathbf{r})\mathbf{r}\right\rangle, \qquad (108)$$

supplemented by two more members. This formula (107), as well as Ampere's formula (108), also established the existence of longitudinal strength of the magnetic interaction. However, in the formula (107) as in Ampere formula (108), the magnetic interaction force between the parallel elements has had a current value twice that from a practical standpoint, is also unacceptable. In 1976, at the International Symposium on Information Theory (Leningrad) Avramenko RF, Grachev LP, Nikolaeva VI issued a report on the possibility of using a physical field vector potential for practical purposes, the transmission of information in the case of **E** = 0 and **B** = 0 [80]. In 1980, the same authors published a paper [81], which also focuses on the possibility of the existence of longitudinal electromagnetic fields of the vector potential and the possibility of practical use of these fields in bioenergy.

Based on the analysis of different magnetic interactions in 1980. Alechinsky VG offered an even more perfect formula [28]:

$$\mathbf{F} = \frac{J_1 J_2}{C^2 r^3}\left\langle -(d\mathbf{l}_1\, d_2\, \mathbf{l}_2)\mathbf{r} + d\mathbf{l}_2(d\mathbf{l}_1\, \mathbf{r}) + d\mathbf{l}_1(d\mathbf{l}_2\, \mathbf{r})\right\rangle, \qquad (109)$$

that recording almost coincides with formula (23) 4th part of the review. The only difference is a constant sign of the last term (109) that does not distort the law of interaction perpendicular current elements, but excludes current interaction elements that are on the same line.

In 1982 Soluninym AM was published "R-electro-dynamics" [32], which presents another mathematical approach to the analysis of the foundations of modern electrodynamics If the usual F-electrodynamics equations for the potentials play only a secondary role and supporting , the author of the proposed R-electrodynamics they are already starting the construction of the field equations, ie,

$$\partial_\alpha \partial^\alpha A^\beta = -\frac{4\pi}{C} J^\beta . \qquad (110)$$

Instead antisymmetric tensor $F_{\alpha\beta}$ introduced tensor

$$R_{\alpha\beta} = \partial_\alpha A_\beta . \qquad (111)$$

Then the equations for the field potentials take the form

$$\partial_\alpha R^\alpha = -\frac{4\pi}{C} J^\beta . \qquad (112)$$

Author's research led him to the conclusion that between moving charges and currents elements exist only potential interaction forces

$$\mathbf{F} = -\frac{J_1 J_2}{C^2 r^3}(d\mathbf{l}_1 d\mathbf{l}_2)\mathbf{r} . \qquad (113)$$

And the record (113), the author gives some other equivalent form:

$$\mathbf{F} = \frac{e_2}{C}[\mathbf{V}_2 \times \mathrm{rot}\mathbf{A}_1] - \frac{e_2}{C}(\mathbf{V}_2 \nabla)\mathbf{A}_1 . \qquad (114)$$

It is interesting to note the point that the author's research led him to the conclusion that the existence of another scalar field

$$\sigma = \frac{1}{C}(\mathbf{V} \cdot \mathbf{E}), \qquad (115)$$

which, unfortunately, he did not dare to call magnetic.

In 1984 VV Geydt (Computing Center of the USSR Academy of Sciences, Novosibirsk) in their theoretical studies have also concluded that the possible existence of additional member of the longitudinal magnetic interaction in the Lorentz formula [31]. Using the formalism of tensor-conformal

transformations, he was dependent for the force acting on a moving charge, which is a first approximation corresponds to the formula (23) 4th part of this review.

In 1984 he published an article Trukhanova KA "vector potential of the electromagnetic field" [82], which considers the impact of the vector potential field of the Earth, the Sun on biological objects and the biosphere on a global scale in relation to the entire world as a whole. Provides an interesting assessment of the vector potential field of the Earth are 1-2 orders of magnitude smaller than its magnetic fields. However, there are some features of the vector potential field of the Earth in the nature of a smaller decline with distance and their distribution in space. Especially focuses on the existence of a world of hidden sources of toroidal field of the vector potential, magnetic devices that are not registered. The problem of the vector potential is estimated to be globally applied even to the entire universe. The physical nature of the vector potential field is substantiated by positive results of experiments Aharonov-Bohm effect. The author mentions the positive results of experiments Mereero, which revealed the impact of the vector potential field on a current in a superconductor, as well as on the course of nuclear reactions.

Thus, for many authors and in different ways came almost to the same conclusions as the vector potential field has a real physical entity and that there must be another phenomenon longitudinal magnetic interaction. In early 1982 the author of this review was given a series of direct experiments to detect phenomena of motion of the conductor in the direction of the current in it. In 1982, the press published the results of experience Grano [3, 41, 42], which describes the phenomenon of movement of the copper conductor in the mercury along the direction of the current in it. In 1983, the author of the review was made, in fact, already a classic version of the experience of the Aharonov-Bohm effect. Instead of accelerated electrons, which were used in the experiment of Japanese physicists [17] were used conduction electrons movable conductor disposed along the axis of the magnetized toroid closed in its field of the vector potential. By passing a current through a conductor was detected longitudinal magnetic push-pull or movable conductor on the toroid axis along the direction of the current in it. In 1984 Okolotinym In S. Rumyantsev D and E. was verified experience Grano [43] and found that the geometry of the end of the movable conductor is of secondary importance in detecting the effect, as the non-conductive coating varnish end of the conductor leads to a marked increase in effect. In 1984 Soluninym A M. A and B. Kostin was made is a direct analogue of the classical experience of the Aharonov-Bohm effect with the electron beam along the axis of the toroid and the existence of the phenomenon of change of velocity of electrons in the field of the vector potential toroid [65].

In recent years, the problem of the vector potential of the magnetic field and the second was the subject of discussion and debate on scientific seminars. In 1984, the Computing Center of the USSR Academy of Sciences (Novosibirsk) the scientific seminar "New methods of electrodynamics and their applicability to geophysics", which heard reports Geydta In B. and G. Nikolaev In .. In 1985, the author was invited to ISU (Ivanovo) on inter-institutional scientific seminar "The electrodynamic experiments and their interpretation in the framework of Maxwell's theory", which made two presentations on the theoretical and experimental part of the work.

In 1986, the Computing Center of the USSR Academy of Sciences held a joint inter-institutional seminar "New methods of electrodynamics and their applicability to geophysics", which heard reports Geydta In V. (Novosibirsk), Nikolaev GV (Tomsk), Vladimir Dubrovsky A. (Moscow), Solunina AM (Ivanovo). Planned for the new scientific seminar with the invitation of a wider range of interested professionals. Conducting scientific discussion and debate have shown the relevance of the problem of the vector potential and the second magnetic field and its applicability to many areas of research.

3. Engineering and Science. - 1983. -№ 2, 10, 11; 1984.-№1.

9. Neiman LR, KS Demirchian Theory of Electrical Engineering, Vol.2. - L .: Energy, 1975. - S. 270 - 276.

10. Nikolaev GV 1. Displacement currents and radial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep VINITI, reg. № 3487-78.

15. Nikolaev GV IV. Justification of the reality of the axial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 528-79.

17. Observation of the Aharonov - Bohm // Nature. - 1983. - № 7. - S. 106.

18. M. Danos effect Aharonov - Bohm quantum mechanics electrical transformer // Physics abroad. Ser. B. - M .: Mir, 1984. - S. 100-105.

19. darling BN The theory of the effect Aharonov - Bohm. - Dep. VINITI, reg. № 2931-80.

20. Solunin AM K-electrodynamics and the effects of the vector potential. -Dep. VINITI, reg. № 5416-85.

21. Nikolaev GV II currents bias and radial magnetic field of a linear current / Ed. Zh."Proceedings of the universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 3488-78.

22. Nikolaev GV V. The system of equations for the axial (scalar) and radial (vector) magnetic fields of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2664-80.

23. Nikolaev GV The laws of mechanics and electrodynamics near-Earth space. Vol. 1. - S. 541 (R & D. - State. Register. № 74007254, B324555otU. 1974.).

24. Nikolaev GV The limits of applicability of classical and relativistic electrodynamics in near-Earth space. Vol. 2. - P. 164 (R & D. - State. Register. № 74007254, B340882 from X. 1974).

25. GV Nikolaev, Okulov BV On the inertial properties of the electrons / Ed. Zh."Math. Universities. Physics." - Tomsk, 1978. - Dep. VINITI, reg. № 4399-77.

27. Ampere AM Electrodynamics. - Moscow: USSR Academy of Sciences, 1954.

28. Alechinsky VG On the question of the impact of the current formula electrodynamic elements // Math. universities. Electromechanics. - 1980. - №4.- S. 431 -434.

29. Sinelnikov EM, Sinel'nikov DE Ponderomotive interaction of two elementary bodies in a quasi-stationary magnetic field // Math. universities. Electromechanics. - 1976. -№1. - S. 13-18.

30. Sinelnikov DE, Sinel'nikov EM Formula for determining the force interaction current elements // Math. universities. Electromechanics. - 1978. - №3. - S. 227 - 235.

31. Gade VV Conformal version of Maxwell's equations and the Lorentz. - Novosibirsk, 1985 / Preprint, USSR Academy of number 588.

32. Solunin AM K-Electrodynamics // Interuniversity collection of ISU, Ivanovo, 1982. - Dep. VINITI, reg. № 3908-82.

33. Nikolaev GV On the laws of electrodynamics and optics in rotating frames of reference relative to the Earth / Red. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 2911-74.

34. GV Nikolaev, Okulov BV On the exponential justify the principle of relativity / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 3064-74.

35. Nikolaev GV The paradox of Feynman and asymmetry laboratory and moving reference frames / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 1937-75.

36. Nikolaev GV Hall effect and the asymmetry of the laboratory and the moving reference frames / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 2507-75.

37. Nikolaev GV On the Limitations of classical and relativistic electrodynamics in the conditions on the surface of the Earth / Red. Zh."Math. Universities. Physics." - Tomsk, 1976. - Dep. in VNITI, reg. № 3277-75.

38. Nikolaev GV On checking the fundamental relations in the satellite / Ed. Zh."Math. Universities. Physics." - Tomsk, 1976. -Dep. VINITI, reg. № 3429-75.

41. Graneou P. Electromagnetic jet-propulsion in the direction of carrent flow // Nature. - 1982. - V. 295. - № 5847. - P. 311 - 313.

42. 1. Science News. - 1982. - V. 121. - .№ 7. - P. 104.

43. Okolotin VS, Rumyantsev DE Experiments Grano: the power of number 4 or focus? // Engineering and Science. - 1983. -№11. - S. 26 -27.

62. GV Nikolaev, Okulov BV Lavrov MD A device for measuring the speed, mobility and concentration of the sign carriers of electric current in a solid // Application for invention. AS Number of 13.06.77g 661,656. Bull. Number 17, 1979.

63. GV Nikolaev, Petrik VA device for measuring the angular velocity of rotation of the object // Application for invention. AS Number of 19.12.78g 777,581. Bull. №41, 1980.

64. Nikolaev GV Korshunov GS Spark gap // Application for invention. AS Number 913,494 by 07/21/80, the Bull. Number 10, 1982.

65. Solunin AM, Kostin AV On the effect of the potential for a toroidal solenoid. - Dep. VINITI, reg. № 7900-84.

72. Nikolaev GV III. Bias currents and axial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 592-79.

79. Solunin A. M .// Math. universities. Physics.- 1972.-№7.-C. 107.

80. Avramenko RF, Grachev LP, Nikolaeva VI Description of the electromagnetic field with the potentials and problems of transmitting information // International Symposium on Information Theory. -A., 1976.

81. Avramenko RF, Nikolaev VI, Pushkin VN On the question of information interaction isolated systems without energy transfer // Problems of Mental Health, psychophysiology, sociology of labor in the coal industry and psychoenergetics: Sat. - M., 1980. - S. 341-357.

82. KA Trukhanov The vector potential of the electromagnetic field // Electromagnetic fields in the biosphere: Sat. - M .: Nauka, 1984. - Vol.1 - S. 331 - 350.

88. Atsyukovsky VA Introduction to Etherodynamics. - Dep. VINITI, reg. № 2760-80.

89. TI Shaovalova Electrodynamics: experiments for problem-based learning. - Tashkent: Ukituvchi, 1985.

90. Kuhn T. The Structure of Scientific Revolutions. - M .: Progress, 1977. - P. 59.

91. Nikolaev GV Unipolar current generator - AS N 1064845 from 06.29.82, the

92. Nikolaev G.V.- "MHD generator" - AS N 1228759 ot02.02.83 city

93. Nikolaev GV Korshunov GS, complicating VV - "Managed spark gap with laser ignition" - Ac. N1194231 from 5.01.84g.

94. Nikolaev G.V.- "Linear motor" - Ac. N 1226579 from 13.06.84g.

95. Nikolaev GV Korshunov GS, complicating VV .- "Managed spark gap" - Ac. N 1264799 from 30.12.84g.

96. Nikolaev GV - "The discharge chamber to form a plasma compression and" Ac. N 1248525 from 11.10.84, the

97. Nikolaev GV - "Electromagnetic pump" - Ac. N 1313303 from 13.02.85, the

98. GV Nikolaev, Krasnyatov JA, Schneider VB, complicating VV - "The electrodynamic rail accelerator" - AS N 4122598 from 02.07.86, the

99. Nikolaev G.V.- device magnetization of the fluid. "- Application N95114277 / 25 05.08.1996g.-patent N2121115

100. Nikolaev GV, GN Novikov ..- Fan-ozonizer. The decision to grant a patent on the invention application N96108283 / 06 (013,666) with a priority from 23.04.96, the - Patent N2121115

---

6. Additional information to the controversial issues of electrodynamics

1. In the scientific literature, in general, it is known that the third law of mechanics, electrodynamics is broken. Unfortunately, not all authors benefits electrodynamics and monographs in the past and in the present felt the need to mention this unpleasant fact, since this issue a lot of obscure and contradictory. If the author can not give any further explanation on this issue, we find it is better not to mention it. As a result of familiarity with such sources on electrodynamics can really get the impression that no violations of the third law of mechanics, electrodynamics at all. And that such statements just slip some reviewers. However, the same reviewers who are familiar, to some extent, with this contradictory situation in electrodynamics, refer mainly to the book Tamm [13], which sets out some of the explanations for this paradox. The book Tamm, reads in part: *"In the case of direct current is necessarily closed, is a violation of Newton's third axiom is related only to the current representation of the interaction forces as forces pairwise interaction of the elements .... The forces of interaction between the two closed currents satisfy the principle of equality of action and reaction. "* Citing as an authoritative statement, without delving into the meaning of what has been proved, the reviewers believe that the question of the interaction of currents is already final decision and not subject to further discussion. Of course, the credibility of the author is large enough, and if the interests of the knowledge of the actual physical nature of the phenomenon is not put in the first place, then such authority is easy to hide behind as an impenetrable shield that actually sometimes the case. What is the physical meaning given in the book Tamm evidence and can it be considered that the evidence does eliminate known in electrodynamics paradoxical situation in violation of the third law of mechanics? First of all, you should pay attention to the fact that the book Tamm, in general, does not deny the existence of serious contradictions in electrodynamics with the third law of mechanics for the case of "pairwise" interaction of the individual elements of the current. And, in particular, the six lines above taken from the book Tamm reference expressly states that *"particularly sharply manifest violation of the principle of equality of action and reaction* (emphasis in the book!) *in the case if, for example,* $D\,\mathbf{S}_1$ *parallel* $\mathbf{R}_{12}$ *and* $D\,\mathbf{S}_2$ *perpendicular to* $\mathbf{R}_{12}$ (in the case of perpendicular current components) . *In this case,* $|dS_1 \times R_{12}| = 0$ *, and therefore* $F_{12} = 0$,

whereas | dS $_2$ x R $_{12}$ | ≠ 0 *and* F $_{21}$ ≠ 0 , *the element* D **S** $_1$ *(current) experiences a force from the element* D **S** $_2$ *(current), but he does not act on it. "* The following is for these conclusions the author about the case *"DC currents, by necessity are closed .. . "* , which decided to refer the reviewers, reflect only an attempt to escape from the author of explicit (and not rejected by him) conflicts with the third law of mechanics, electrodynamics, but in the case of closed currents, with some help, in general, formal mathematical priori assumptions and conclusions. Consequently, the book Tamm there is no evidence that the paradoxical situation in violation of the third law of mechanics, electrodynamics for the case of the elements of the current permitted and is not relevant.

As for the evidence cited in the book about the possibility of escape from this paradoxical situation, if we consider the interaction of closed contours, the subject of discussion as time and should be used in the proof of formal mathematical methods and a priori assumptions. For greater reliability turn to specific examples.

Consider a simple example of the magnetic interaction between the two coplanar rectangular contours AVSD and A'V'S'D '(Fig. 1).

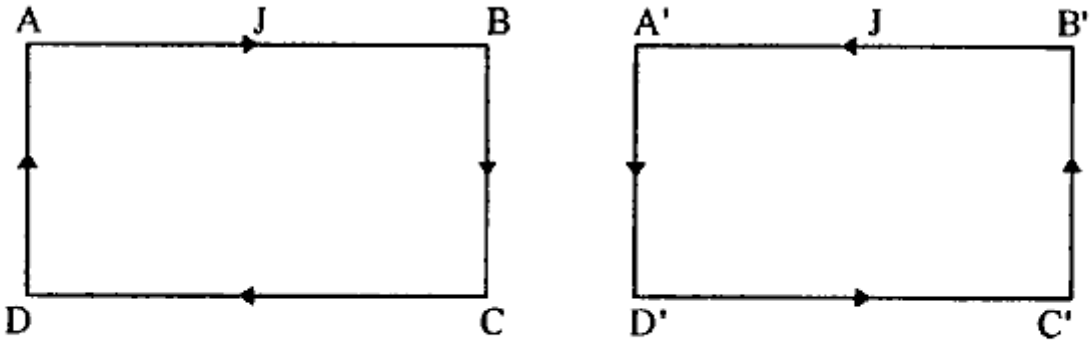


Рис. 1

To determine the effect of "magnetic field" one circuit AVSD on another circuit current A'V'S'D ', you must find the total magnetic field **H** $_0$ contour AVSD at points along the sides of the other circuit A'V'S'D 'with the current, but This determination can be accomplished by known integral depending

$$\mathbf{H}_o = \int_A^B d\mathbf{H} + \int_B^C d\mathbf{H} + \int_C^D d\mathbf{H} + \int_D^A d\mathbf{H}, \qquad (1)$$

reflects the physical principle of superposition. According to this principle, and ignoring it is unacceptable for a professional cumulative effect of all "magnetic field" **H** $_0$ AVSD circuit currents in the sides 'B', B'C, S'D 'D'A' circuit A'B'C 'D'

$$F_o = \frac{J}{C}\int_{A'B'C'D'}[d\mathbf{l}\times\mathbf{H}_o] = \frac{J}{C}\left\langle \oint_{A'B'}[d\mathbf{l}\times\mathbf{H}_o] + \oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_o] + \oint_{C'D'}[d\mathbf{l}\times\mathbf{H}_o] + \oint_{D'A'}[d\mathbf{l}\times\mathbf{H}_o]\right\rangle \qquad (2)$$

the sum of the action of magnetic fields of the currents on each side AVSD circuit currents in the sides' B ', B'C, S'D' D'A 'circuit A'V'SD' t. e.

$$\mathbf{F}_0 = \frac{J}{C}\left\langle \oint_{A'B'}[d\mathbf{l}\times\mathbf{H}_{AB}]+\oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_{AB}]+\oint_{C'D'}[d\mathbf{l}\times\mathbf{H}_{AB}]+\oint_{D'A'}[d\mathbf{l}\times\mathbf{H}_{AB}]\right\rangle +$$
$$\frac{J}{C}\left\langle \oint_{A'B'}[d\mathbf{l}\times\mathbf{H}_{BC}]+\oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_{BC}]+\oint_{C'D'}[d\mathbf{l}\times\mathbf{H}_{BC}]+\oint_{D'A'}[d\mathbf{l}\times\mathbf{H}_{BC}]\right\rangle +$$
$$\frac{J}{C}\left\langle \oint_{A'B'}[d\mathbf{l}\times\mathbf{H}_{CD}]+\oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_{CD}]+\oint_{C'D'}[d\mathbf{l}\times\mathbf{H}_{CD}]+\oint_{D'A}[d\mathbf{l}\times\mathbf{H}_{CD}]\right\rangle + \quad (3)$$
$$\frac{J}{C}\left\langle \oint_{A'B'}[d\mathbf{l}\times\mathbf{H}_{DA}]+\oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_{DA}]+\oint_{C'D'}[d\mathbf{l}\times\mathbf{H}_{DA}]+\oint_{D'A'}[d\mathbf{l}\times\mathbf{H}_{DA}]\right\rangle .$$

Moreover, in a real case in determining the total force $\mathbf{F}_0$ (3) specific practical problems have to determine these multiple integrals, reflecting nothing more than as a paired magnetic interaction of the contour, as another way to determine the impact of all "magnetic field" circuit AVSD currents in the sides of the contour A'V'S'D 'in physics simply do not know. Thus, the dependence (3) reflects the effect of all "magnetic field" $\mathbf{H}_0$ AVSD circuit currents on another circuit, but the analysis of this relationship in the framework of known ideas concerning the interaction of the current with the magnetic field immediately reveals oddities. Firstly, the members 1 and 11 are generally equal to zero on the right. In addition, pairwise members 3 and 9, 7 and 5, 13 and 15 also give zero total force interaction. So that the interaction force **F** (3) between the closed contours will be determined only all members of the 8th dependence (3), ie. e.

$$\mathbf{F}_0 \equiv \frac{J}{C}\left\langle \oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_{AB}]+\oint_{D'A'}[d\mathbf{l}\times\mathbf{H}_{AB}]\right\rangle + \frac{J}{C}\left\langle \oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_{BC}]+\oint_{D'A'}[d\mathbf{l}\times\mathbf{H}_{BC}]\right\rangle +$$
$$+\frac{J}{C}\left\langle \oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_{CD}]+\oint_{D'A'}[d\mathbf{l}\times\mathbf{H}_{CD}]\right\rangle + \frac{J}{C}\left\langle \oint_{B'C'}[d\mathbf{l}\times\mathbf{H}_{DA}]+\oint_{D'A'}[d\mathbf{l}\times\mathbf{H}_{DA}]\right\rangle , \quad (4)$$

in other words, the effect of magnetic fields H_{AB}, H_{Sun}, H_{DM}, N_{YES} all four sides of the contour AVSD (or the action of all "magnetic field" H_0 loop) only on two sides B'C and D'A 'closed loop A 'B' S'D '. Already at this stage, and in the framework of generally accepted ideas, found a paradox lies in the fact that the action of all "magnetic field" H one circuit extends for some reason not all current-carrying conductors of another circuit, but only two conductors B'C 'and D'A'. Since the resulting effect on the currents of the other two sides 'B' and S'D 'circuit A'V'S'D' is zero, then it is clear that the total force $\mathbf{F}_0$ (4) magnetic action will not change its value if currents in the sides of the 'B' and S'D 'will generally be excluded from consideration. For example, if the currents in the sides B'C, D'A 'present in the form of moving the charged conductors (or charged particle beam), the effect of these currents (beams) from the total of "magnetic field" $\mathbf{H}_0$ closed loop just AVSD and to determine the dependence (4) in full

accordance with the known concepts of the laws of magnetic interaction. However, if at the same time try to solve the inverse problem and within the same well-known representations now determine the total "magnetic field" **H '** two sides of the segments in the current B'C, D'A 'and to determine the effect of this "magnetic field" $\mathbf{H}_0$ 'on circuit currents AVSD, I immediately find that the cumulative effect of $\mathbf{F}_0$ 'is defined now only four nonzero terms:

$$\mathbf{F}_o' = \frac{J}{C}\left\langle \oint_{BC'}[d\mathbf{l}\times\mathbf{H}_{B'C'}] + \oint_{DA}[d\mathbf{l}\times\mathbf{H}_{B'C'}]\right\rangle + \frac{J}{C}\left\langle \oint_{BC}[d\mathbf{l}\times\mathbf{H}_{D'A'}] + \oint_{DA}[d\mathbf{l}\times\mathbf{H}_{D'C'}]\right\rangle \qquad (5)$$

and that the size of the force $\mathbf{F}_0$ '(5) no longer corresponds to the force $\mathbf{F}_0$ '(4). Once again there is a flagrant violation of the third law of mechanics, and in the case of the interaction of all "magnetic field" circuit with constant current with placed within the field of the other segments of the current. The question arises, what caused the emergence of this contradiction? If you come back to the expression (4), we can find that on the current segment A'D 'circuit A'V'S'D', for example, the influence of magnetic field on all four sides of the loop AVSD and create at the same time the interaction force directed a straight line connecting the circuit in question. If we recall the laws of mechanics, we must, of course, expect that on all four sides of the contour AVSD should be allocated an equal and opposite reaction on the part of the magnetic field of the segment current A'D 'circuit A'V'S'D'. However, if you get a similar (4) the expression for the force of interaction of the magnetic fields of the contour A'V'S'D 'with the parties contour AVSD, suddenly determines that the Party A'D' its magnetic field creates a reaction in the direction of the line joining the circuit in question only two sides BC and DA circuit AVSD, but not all four sides, as this would be expected in accordance with the laws of mechanics. In particular it is found that side A'D 'its magnetic field for currents in the sides AB and CD loop AVSD do not act along the line connecting the data path. That is to say that does not create a reaction that must be considering the feasibility of mechanics. Therefore, if we assume that the laws of mechanics must be carried out, then the sides AB and CD loop AVSD should act 4 more additional reaction forces from the sides A'D 'and B'C A'V'S'D circuit', which in the expression (4) is simply not reflected due to the limited use of representations of the laws of magnetic interaction. In turn, considering the additional reaction force fully, each of the paired members 5 and 7, 13 and 15 in the expression (4) would not be zero. In this case, all parties A'V'S'D loop '(rather than two sides A'D' and B'C) will be subject to the action already from all sides of the same circuit AVSD without any contradictions.

Thus, the zero contribution of members 5, 7, 13, 15 in the expression (4) is precisely due to the limited use of generally accepted ideas about the law of magnetic interaction. The analysis is also becoming clear that the satisfaction of the third law of mechanics in the magnetic interaction between a closed loop with the other, within the framework of known concepts, due to only the fact that, when considering the actions of one circuit to another completely ignored the longitudinal reaction to his sides by the other path, the existence of which is necessary, subject to the feasibility of the third law of mechanics. Conversely, when the review of the first to the second circuit, again completely ignored longitudinal reaction already at its sides by the first circuit. Since the action and counteraction of the contour ignored the existence of equal and identical nature of the longitudinal magnetic reaction forces, the equality of action and reaction in the interaction of closed contours is generally respected, but somewhat low total force of interaction between them. Whereas, taking into account the feasibility of the third law of mechanics in the magnetic interaction between the sides of the contour that condition of equality of action and reaction is simply a natural condition, but only if some increase in the total strength of the interaction between these closed loops. Consequently, we can already clearly state that in the framework of known representations satisfaction third law of mechanics in the magnetic interaction

of closed contours achieved through a gross distortion of the real physical nature of the phenomenon and, moreover, a change in its value.

It should be noted that the very fact that the possibility of a gross violation of the third law of mechanics in the perpendicular magnetic interaction between the elements of the current immediately follows that in view of the feasibility of the principle of superposition is also a flagrant violation of the third law of mechanics should be expected in the magnetic interaction, again, perpendicular, but macroscopic segments current components, for example, the actual closed circuit, and that in fact the case. Well, if so, principled approach to resolve any conflicts with the third law of mechanics, electrodynamics should be based primarily on the elimination of these contradictions in the initial assumptions of this theory, admitting the possibility of such violations in the magnetic interaction between the paired elements of the current.

2. Defending the possibility of eliminating violations of the third law of mechanics, electrodynamics transition to closed currents, as shown in the book Tamm reviewers never mention that the formalism of mathematical proofs of this transition is based on the transition from the Lorentz function of interaction between the parties circuits the potential interaction function, from which clearly implies the possibility of existence is denied reviewers phenomena longitudinal magnetic interaction. Hiding behind the authority of books in cases where the question is raised about violations of the laws of mechanics to electrodynamics, reviewers try to just be silent enough correct, but essentially formal conclusions of the author of the book is when the question is raised about the existence of longitudinal magnetic forces directed along the current. Unfounded denying the possibility of the existence of longitudinal forces of magnetic interaction, reviewers somehow try not to refer to the authority of the book Tamm and complain already in the absence of experimental evidence in physics of this phenomenon. Meanwhile, to be consistent, reviewers should be, first of all, to clarify the findings Tamm, of which should obviously not Lorentz law of interaction between the elements of D $\mathbf{L}_1$, D and $\mathbf{L}_2$ closed loops:

$$\mathbf{F} = \frac{J_1 J_2}{C^2} \iint_{l_1 l_2} \frac{(d\mathbf{l}_1 \cdot d\mathbf{l}_2)\mathbf{r}}{r^3} \,. \qquad (6)$$

Similar records for the forces of interaction of the elements of the current used in other studies [83]. For a complete understanding of the existing dependence (6) perform the analysis presented in the book Tamm (p. 228), the transition from non-potential interaction function to the potential.

Consider the interaction of closed loop AVSDKM with the current J_1 with the magnetic field **of** $\mathbf{H}_2$ from the element D $\mathbf{L}_2$ current J_2 (Fig. 2).

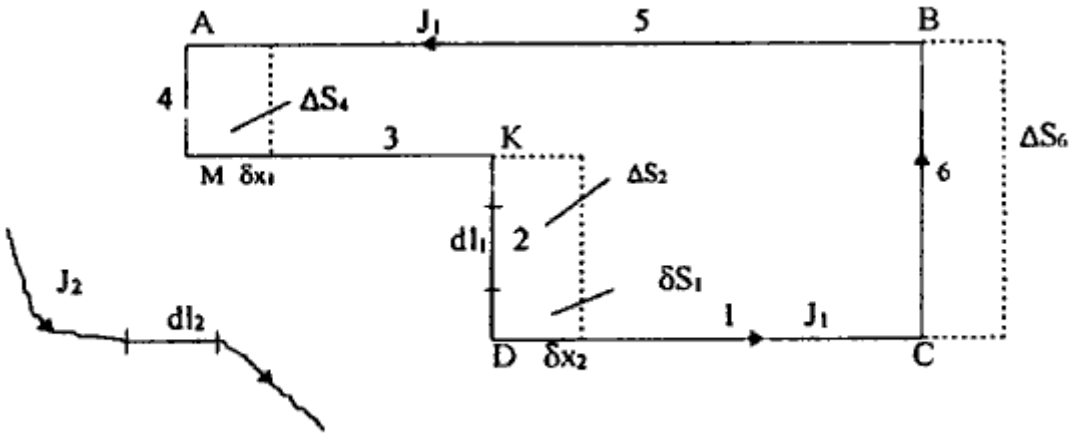


Рис. 2

Linear element D **L** $_2$ current J $_2$ is selected in such a way that it is located on a straight line with a side of SD closed loop and parallel to the sides AB and KM. In a magnetic field **H** $_2$ D element **L** $_2$ of the current J $_2$ on any element of D **L** $_1$ current J $_1$ closed loop the Lorentz force

$$\mathbf{F} = \frac{J_1}{C}[d\mathbf{l}_1 \times \mathbf{H}_2]. \tag{7}$$

We define the work done by a closed loop with a constant current J $_1$ in a magnetic field **H** $_2$ when moving virtual δx along the side of the DS. In this case, for movement of any element D **L** $_1$ circuit can obviously be written

$$\mathbf{F}\delta\mathbf{x} = \frac{J_1}{C}\,\delta\mathbf{x}\,[d\mathbf{l}_1 \times \mathbf{H}_2]. \tag{8}$$

The total work δA, associated with the movement of all the elements of L with a current J $_1$, is equal to

$$\delta A = \oint \mathbf{F}\,\delta\mathbf{x} = \frac{J_1}{C}\oint_L \delta\mathbf{x}\,[d\mathbf{l}_1 \times \mathbf{H}_2] = \frac{J_1}{C}\oint_L \mathbf{H}_2[\delta\mathbf{x} \times d\mathbf{l}_1] \tag{9}$$

where | delta **x** x D **L** $_1$ | = δS $_1$ - there is an element of area, describe the elements of D **L** $_1$ when moving virtual delta **x** .

With regard to (9) for 6A can also be written

$$\delta A = \frac{J_1}{C}\oint_L \mathbf{H}_2\,\delta\mathbf{S}_1 = \frac{J_1}{C}\int_\Delta \mathbf{H}_2\,\delta\mathbf{S}_1 = \frac{J_1}{C}\,\Delta\Phi, \tag{10}$$

that is, the integration can be carried out already on the sides DC, MA, BC, as the other side of the magnetic flux ΔF from the magnetic field H $_2$, by assumption, do not cross. Entries (10) can be given another view

$$\delta A = \frac{J_1}{C}\left(\delta\Phi_2 + \delta\Phi_4 + \delta\Phi_6\right) = \delta A_2 + \delta A_4 + \delta A_6 . \qquad (11)$$

Fig.2 shows that the magnetic fluxes F_2, F_4, F_6 are localized mainly about those aspects of the circuit, which is accomplished by moving the work δA_2, δA_4, δA_6, and contribute to the work δA each of these parties is determined by the amount of force (7) acting on the element D $\mathbf{L}_1$ of these parties and directed along the direction of movement delta **x** . Therefore, the conclusion is that the magnetic interaction AVSDKM closed loop with the magnetic field H_2 D element $\mathbf{L}_2$ of the current J_2 is caused mainly by reaction of its sides DC, MA, BC, the movement of which is precisely the work done δA (9). However, it can be shown that (10) for δA, ie expression

$$\delta A = \frac{J_1}{C}\int_{\Delta} \mathbf{H}_2 \delta \mathbf{S}_1 = \frac{J_1}{C}\Delta\Phi , \qquad (12)$$

quantity does not change, if we assume that the flow does not change ΔF near the sides DC, MA, BC, and within the entire closed loop L, covering a surface S, ie,

$$\delta A' = \frac{J_1}{C}\int_{S} \mathbf{H}_2 \delta \mathbf{S}_1 = \frac{J_1}{C}\Delta\Phi \equiv \delta A . \qquad (13)$$

In the latter case, using Stokes theorem to (13) can be written

$$\delta A' = \frac{J_1}{C}\int_{S} \mathbf{H}_2\, \delta \mathbf{S}_1 = \frac{J_1}{C}\int_{S} \mathrm{rot}\, \mathbf{A}_2\, \delta \mathbf{S}_1 = \frac{J_1}{C}\oint_{L} A_2 dl \quad . \qquad (14)$$

Taking into account that for the vector potential A_2 from the element D $\mathbf{L}_2$ current J_2 is true record

$$\mathbf{A}_2 = \frac{J_2 d\mathbf{l}_2}{Cr} , \qquad (15)$$

for δA '(14) finally set

$$\delta A' = \frac{J_1 J_2}{C}\oint_{L} \frac{(d\mathbf{l}_1\, d\mathbf{l}_2)}{r} . \qquad (16)$$

If we consider that the scalar product of the integral is not zero only for the sides AB, CD, CM, then the expression (16) is equivalent to the expression

$$\delta A' = \frac{J_1 J_2}{C}\left\langle \int_{CD} \frac{(d\mathbf{l}_1 d\mathbf{l}_2)}{r} + \int_{KM} \frac{(d\mathbf{l}_1 d\mathbf{l}_2)}{r} + \int_{AB} \frac{(d\mathbf{l}_1 d\mathbf{l}_2)}{r} \right\rangle = \delta A_1 + \delta A_3 + \delta A_5 \ , \qquad (17)$$

from which it follows that the magnetic interaction AVSDKM closed loop with the magnetic field H $_2$ D element **L** $_2$ of the current J $_2$ is caused mainly by reaction of the parties already DM, KM, AB loop of the vector potential A $_2$ element D **L** $_2$. And in conjunction with the element D **L** $_2$ current J $_2$ is involved even side SD closed loop lying on a straight line with an element of D **L** $_2$, whereas the usual Lorentz interaction between them at all excluded. From the analysis of (9) and (13) can be done already concluded that the assumption (13), in general, is, from a mathematical point of view, quite correct, but from a physical point of view, the transition from (9) to (13) can not be considered valid because it leads to a significant change in the physical essence of the phenomenon. Formal character made (13) assumption is that on the side of the closed loop AVSDKM actual magnetic Lorentz force **F** (7) were distributed to the parties on a different circuit to the law. Since the change in flow ΔF (10) in a closed loop L was irrespective of the parties of this circuit, the Lorentz law pairwise interaction element D **L** $_2$ current J $_2$ with elements of D **L** $_1$ current J $_1$ closed loop, contrary to the third law of mechanics, is not replaced contrary to the third law of mechanics the potential interactions of these same elements in different combinations. However, no real physical meaning of such a replacement has not. For example, if the same exercise for the replacement of two interacting loops (See above. p / n 1 of this part), we can see that if the initial magnetic interaction between the circuits was due partly to a potential part of the Lorentz interaction (the first term on the right):

$$\mathbf{F} = \frac{e}{C}[\mathbf{V} \times \mathrm{rot}\ \mathbf{A}] = \frac{e}{C}\nabla(\mathbf{A}\cdot\mathbf{V}) + \frac{e}{C}(\mathbf{V}\cdot\nabla)\mathbf{A} \qquad (18)$$

and part-time non-potential part (not taken into account in the interaction reaction perpendicular to the contour), then after replacing the interaction is due to already fully part of the interaction potential, but in the absence of interaction between nonpotential perpendicular to the contour. In both the first and second cases physics of the interaction between the closed contours of the reflecting incomplete.

3. Much attention in discussions with reviewers to consider issues related to the phenomenon of motion U-shaped conductor, and the problem of so-called "railgun engines." The essence of the problem, which has been described by Ampere [27], is that one transverse Lorentz forces the correct explanation of the phenomenon can not be found. Despite the fact that the paradox of the situation with a U-shaped conductor in electrodynamics is, in general, has long been known in the discussions reviewers are making strenuous efforts to give a consistent explanation for this phenomenon, and in the framework of the well-known representations. In their submissions reviewers, in particular, argued that *"the problem of determining the impact of the current is divided into two ...: a) determining the magnetic field of arbitrary power, and b) determining the forces operating in a given magnetic field to accommodate the current."* On the basis of these general arguments about the

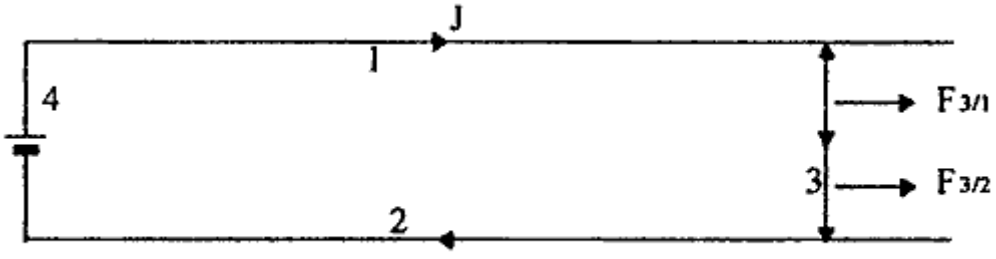


Рис. 3

effect of all "magnetic field" on the current concludes that *"no violation of the third law of mechanics for direct currents do not, including devices for so-called" railgun type. "* In order to understand the essence of the paradoxical situation, consider a number of specific examples.

Consider the phenomenon of motion linear conductor 3 electrodynamic engine "railgun type" (Fig. 3).

For authenticity shall use specific numbers that the length of the side AB (1.2) is equal to **L** = 300 cm, and the length of the side BC (3.4) is equal to **L** = 30 cm. In a closed circuit creates an electric current value of J = 400 A. Cross Lorentz force **F** ⊥ magnetic pressure on the conductor 3 is determined by calculations in the framework of known concepts:

$$\mathbf{F}_{\perp} = \frac{J}{C}[d\mathbf{l} \times \mathbf{H}] \qquad (19)$$

and is measured by a dynamometer. To determine the total force $\mathbf{F}_3$ exerted on the conductor 3, first determine, according to the conventional rules, the action of the magnetic fields H_1, H_2, H_4 conductors 1, 2 and 4 in the element current J D $\mathbf{L}_{three}$ conductors 3

$$d\mathbf{F}_3 = \frac{J}{C}[d\mathbf{l}_3 \times \mathbf{H}_1] + \frac{J}{C}[d\mathbf{l}_3 \times \mathbf{H}_2] + \frac{J}{C}[d\mathbf{l}_3 \times \mathbf{H}_4] = d\mathbf{F}_{3/1} + d\mathbf{F}_{3/2} + d\mathbf{F}_{3/4}, \qquad (20)$$

where $H_{1,}$ H_2, N_4 - total magnetic field from a separate current J in the conductors 1, 2, 4 at the location of element D $\mathbf{L}_3$ of the conductor 3.

However, if in contrast to the known concepts in electrodynamics in the expression (20) to add another member

$$d\mathbf{F}_3' = d\mathbf{F}_3 + \frac{J}{C}[d\mathbf{l}_3 \times \mathbf{H}_3] = (d\mathbf{F}_{3/1} + d\mathbf{F}_{3/2} + d\mathbf{F}_{3/4}) + d\mathbf{F}_{3/3}, \qquad (21)$$

the interaction between the element D $\mathbf{L}_3$ 3 conductor with its own magnetic field H_3 conductor 3, such a record would be, obviously, in stark contrast to the known laws of mechanics, as the self-magnetic field H_3 conductor 3 can not participate in the progressive movement of this same conductor. Consequently, for the total force **F** , acting upon all the movable conductor 3 by the magnetic fields H_1, H_2, H_4 fixed conductors, proper account must, obviously, have the form

$$\mathbf{F}_3 = \int_0^{l_3} d\mathbf{F}_{3/1} + \int_0^{l_3} d\mathbf{F}_{3/2} + \int_0^{l_3} d\mathbf{F}_{3/4} = \mathbf{F}_{3/1} + \mathbf{F}_{3/2} + \mathbf{F}_{3/4}. \qquad (22)$$

Substituting into (22) the numerical value of **L** = 300 cm, **L** = 30 cm, **J** = 400 A, for the force $\mathbf{F}_3$ set

$$F_3 = 35 \text{ г.} \qquad (23)$$

Put the experiment [39] were measured force **F** $_3$ acting on the conductor 3, dynamometer and find that it really is **F** $_3$ = 35 Of the compliance calculations with the experimental results, we conclude that the language used in the calculation of the submission of the transverse Lorentz forces **F** $\perp$ (19) and the total force **F** $_3$ (22) acting on the movable conductor 3 are sufficiently accurate. On the other hand, further convinced of the error of the assumption (21). From a comparison of the interaction forces **F** $_{3/1}$, **F** $_{3/2}$ sides 1 and 2 with the movable conductor 3 with a force **F** $_{3/4}$ remote interaction with a moving conductor 4 conductor 3 we find that the force **F** $_{3/4}$ 2000 times less force **F** $_{3/1}$ + **F** $_{3/2}$.

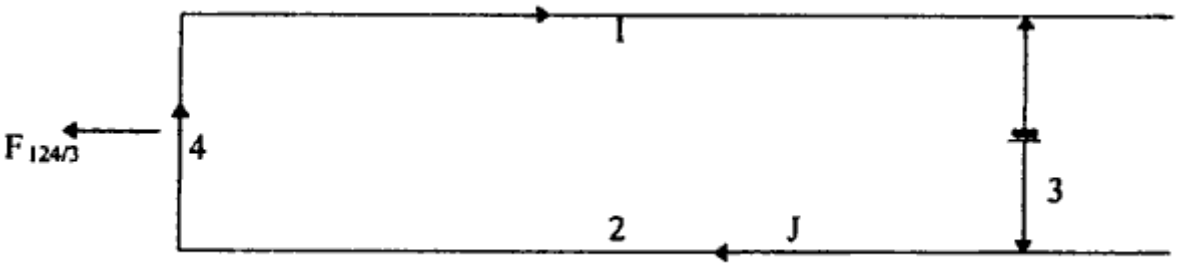


Рис. 4

Please experiment, leaving the conductor 3 alone, and U-shaped conductor (of the conductors 1, 2, 4) provide the ability to move in the opposite direction (Fig. 4).

Using physical concepts embodied in (22) for the force D **F** $_{124}$, acting on the elements of D **L** $_1$, D **L** $_2$, D **L** $_4$ movable conductors 1, 2, 4, with a current J on the part of the magnetic field H $_3$ stationary conductor 3, find

$$d\mathbf{F}_{124} = \frac{J}{C}[d\mathbf{l}_1 \times \mathbf{H}_3] + \frac{J}{C}[d\mathbf{l}_2 \times \mathbf{H}_3] + \frac{J}{C}[d\mathbf{l}_4 \times \mathbf{H}_3] = d\mathbf{F}_{1/3} + d\mathbf{F}_{2/3} + d\mathbf{F}_{4/3} . \quad (24)$$

Location for the total force **F** $_{124}$, acting on the conductors 1, 2, 4, the U-shaped frame, obtain

$$\mathbf{F}_{124} = \int_0^{l_1} d\mathbf{F}_{1/3} + \int_0^{l_2} d\mathbf{F}_{2/3} + \int_0^{l_4} d\mathbf{F}_{4/3} = \mathbf{F}_{1/3} + \mathbf{F}_{2/3} + \mathbf{F}_{4/3} . \quad (25)$$

Since the force **F** $_{1/3}$ and **F** $_{2/3}$ perpendicular to the conductors 1 and 2 is compensated by the presence of tight coupling between these conductors, for the (25) we finally

$$\mathbf{F}_{124} = \mathbf{F}_{4/3} . \quad (26)$$

Substituting into (26) the numerical value of **L** = 300 cm, **L** = 30 cm, **J** = 400 A, for a resultant force **F** $_{124}$, acting on the U-shaped conductor set

$$F_{124} \approx 0{,}017 \text{ г.} \quad (27)$$

Put the experiment [39] and measure force **F** $_{124}$ attached to the U-shaped conductor 1, 2, 4, and as a result of the measurement set that this force is **F** = **'35** From the discrepancy calculation results of the experiment is that used in the calculation of the presentation one transverse Lorentz forces (19) acting on the movable U-shaped conductor, are insufficient. In addition, it should be

noted that within the known concepts of a vector magnetic field and transverse magnetic interaction phenomenon reveals the contradictions is essentially insoluble. And yet, despite the obvious limitations of the known concepts, attempts to circumvent the difficulties in electrodynamics detours continue. It is easy to show that if in the experiment described above to allow the impossible, in terms of the laws of mechanics, and assume that the side of the four U-shaped conductor has put pressure on the magnetic field and strictly related side conductors 1, 2, the total force $\mathbf{F}'_{124}$ acting on the U-shaped conductor is equal to $\mathbf{F}'_{124} = 35$ g, which is just observed in the experiment. It is to such an interpretation of the experimental results was forced to come to the author of this experiment [39], as the other way out of the contradiction could not find. Unfortunately, a similar interpretation of the experimental results with the U-shaped conductor tried to protect some of the reviewers, roughly ignoring certain provisions of the mechanics that internal forces between the conductors of the U-shaped frame may not be the cause of the translational motion of the frame.

4. Another group of reviewers in an attempt to escape from the contradictions in experiments with U-shaped conductor and the "railgun" engines refers to the applicability of these phenomena known potential dependence for energy circuit

$$W_L = \frac{L J^2}{2}, \tag{28}$$

from which it can indeed be found as the force acting on the movable conductor 3 (see. Fig. 3)

$$F_3 = \frac{\partial W_L}{\partial x} = -\frac{J^2}{2}\frac{\partial L}{\partial x}, \tag{29}$$

and an equal and opposite reaction force acting on a fixed U-shaped conductor. Studies show that the magnitude of these forces do indeed correspond to the actually observed in the experiment forces. However, with regard to the movable conductor 3 "railgun" engine dependence (29) does not provide a consistent response on the precise place of application of forces of reaction from the movable conductor. The place of application of the reaction forces now becomes relevant in connection with the fact that the "railgun" guns are already reaction force commensurate with the maximum allowable force for the structure. In addition, in the case of the fixed portions of the circuit according to (29) can not be identify known active loop static magnetic forces. Most important objection to the use of dependence

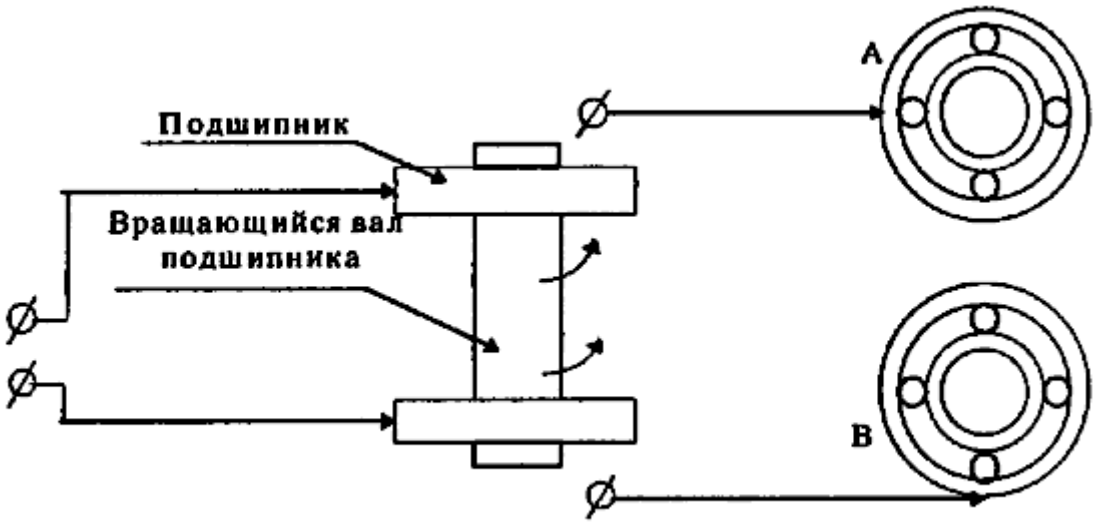


Рис. 5

(29) lies in the fact that this relationship does not affect a paradox problem with "railgun" engines and, moreover, is in stark contrast with the current in the circuit known Lorentz forces. Particularly evident limitations of dependence (29) is found with respect to "railgun" engines, in which the size of the working circuit does not change (see. Experiments 43, 44 third part of the review). One of these original experiments was carried out at the Department of Electrical Machines TPU (Tomsk), when axis, located on two bearings, passed an electric current (DC or AC), having brought it to the outer ring of the bearing (Fig. 5).

In the case of a symmetric current supply (Fig. 5, A) axis "engine" begins to spin in any direction after the first push. In asymmetric (Fig. 5, B) - "engine" begins to work without pre-promotion. This is actually observed in the experiment phenomenon at a constant angular velocity of the rotation axis of the bearings sizes circuit, and hence the inductance **L** , do not change, and the relation (29) is in principle applicable. Analysis of the devices of this type shows that the driving forces of them are nonpotential transverse Lorentz force applied radially to the rotary armature currents, whereas the longitudinal reaction force applied to the currents in the current supply "rail".

5. The interaction of the elements of the current perpendicular to the transverse Lorentz force $\mathbf{F}_{\perp}$ to see the magnetic field $\mathbf{H}_{\perp}$, acting on one element is offset by an equal and opposite to the direction of the longitudinal reaction force from another type of magnetic field $\mathbf{H}_{\parallel}$, attached to the second element, allowing a well-known paradox in electrodynamics the third law of mechanics. Arguing against this interpretation and rejected the possibility of the existence of the second type of magnetic field, some of the reviewers claim that *"the provisions of the author's principle of action and reaction is not actually performed, as the direction of the forces applied to the two elements of the current, are not on the same line."* It should be noted that the question of the validity of the principle of equality of action and reaction in this form is not quite correct. As is known from the literature [84], the nature of the third law of Newtonian mechanics is based on two fundamental propositions, the fundamental of which is different. The first statement , which is a fundamental determinant, states that for two interacting particles (bodies) forces acting on them are equal in magnitude and opposite in direction. This statement defines the fundamental nature of the third law of mechanics and is applicable for all kinds of interactions, both potential and non-potential. Conditions feasibility of the first statement of the third law of Newtonian mechanics is mathematically written as

$$\mathbf{F}_{12} = -\mathbf{F}_{21}. \tag{30}$$

The second assertion , the validity of which is limited by the mechanical interaction and potential interactions through force fields, says that the power of action and reaction force are on the same line. Conditions of satisfaction of the second assertion of the third law of Newtonian mechanics is mathematically written as

$$\mathbf{F}_{12} = F_{12}\frac{\mathbf{r}_{12}}{r_{12}}, \quad \mathbf{F}_{21} = F_{21}\frac{\mathbf{r}_{21}}{r_{21}}. \tag{31}$$

As is known from the literature, the force field **E** (or **H** , etc.) is called potential field if this condition is satisfied

$$\operatorname{rot}\mathbf{E} = 0. \tag{32}$$

In turn, the strength of the interaction of particles in potential fields is called the potential power and is given by

$$\mathbf{F}_{12} = -\frac{\partial U_{12}}{\partial \mathbf{r}_{12}}, \quad \mathbf{F}_{21} = -\frac{\partial U_{21}}{\partial \mathbf{r}_{21}}. \tag{33}$$

For two interacting particles in potential fields are fair both statements of the third law of mechanics (30), (31). Interaction of particles obeying (30) and (31) are called central interactions and forces - central forces.

However, apart from the potential field, there are naturally nonpotential type field, such as fields **A** , $\mathbf{H}_{\perp}$, **E** and t. d., for which the condition (31) is clearly impractical, impossible since the condition (32). For example, in the case of a single charge moving with acceleration for fields $\mathbf{H}_{\perp}$ and **E** have

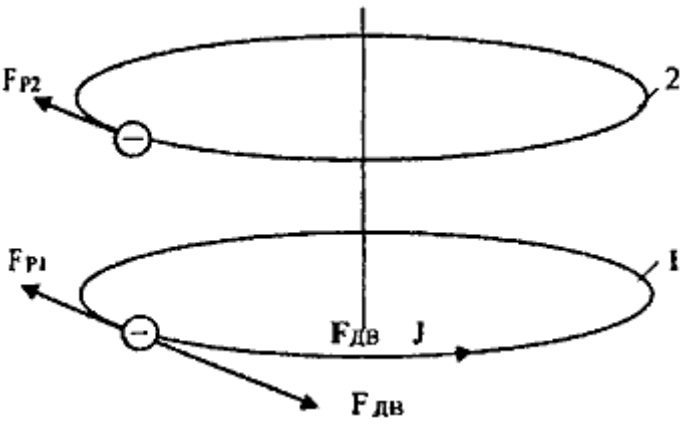
$$\operatorname{rot} \mathbf{H}_{\perp} = \frac{4\pi}{C}\mathbf{j}_{см} + \frac{4\pi}{C}\mathbf{j}^{п}_{см} \neq 0, \tag{34}$$

$$\operatorname{rot} \tilde{\mathbf{E}} = -\frac{1}{C}\frac{\partial \mathbf{H}_{\perp}}{\partial t} \neq 0. \tag{35}$$

For fields nonpotential type (34), (35) and in the presence of particles in the internal vector characteristics (dipole moments, spins, etc...) And in the case of relativistic velocities [84] " the first statement of $\mathbf{F}_{12} = -\mathbf{F}_{21}$, contained in the third law of mechanics (30) remains valid, but the second statement $\mathbf{F}_{12} = F_{12}\frac{\mathbf{r}_{12}}{r_{12}}$ - is unfair. This means that the interaction forces between the particles in these cases cease to be central (directed along the line connecting the particles). "

Thus, the fundamental principle of the third law of mechanics - the principle of equal and opposite action and reaction (30) - should remain valid for all known types of interactions in nature, whereas, under the well-known concepts in electrodynamics there are gross violations of this principle as in the magnetic interactions of elementary charges, and elements of the current in the circuit and in the magnetic interaction of currents closed loop and closed loop between them. In addition, within the framework of known concepts, when that condition (30) and impracticability (31), to draw conclusions about the impracticability of the whole of the third law of mechanics is unacceptable.

For a visual representation of the physical nature of non-potential fields that violate the condition (31), consider for example, the interaction of the vortex electric field nonpotential $\tilde{\mathbf{E}}$ (35) An accelerated charge of a closed circular loop 1 with the same charges as a circular loop 2 (Fig. 6).



Appendix accelerating force $\mathbf{F}_{DV}$ to charges of circuit 1 causes the induction of eddy electric field $\tilde{\mathbf{E}}$, which creates a reaction force $\mathbf{F}_{P1}$ and $\mathbf{F}_{P2}$ on

charges of circuit 1 and 2. Moreover, the reaction force $\mathbf{F}_{P2}$ applied to the charges of the second circuit 2 is not on the same line with the acceleration force $\mathbf{F}_{DV}$ applied to the charge of the first circuit 1. However, the total reaction force ($\mathbf{F}_{P1} + \mathbf{F}_{P2}$) is equal and oppositely directed accelerating force $\mathbf{F}_{ET}$.

6. Consider another controversial investigation known formal methods of electrodynamics used in the book Tamm (pp. 370, 380) to determine the ponderomotive force of the magnetic field from the expression for the energy

$$W_H = \frac{1}{8\pi}\int_v H^2 dV, \tag{36}$$

$$W_A = \frac{1}{2C}\int_v \mathbf{A}\mathbf{j}dV. \tag{37}$$

Referring to the evidence presented in the book reviewers mistakenly believe that these expressions for the interaction energy (36) and (37) are completely equivalent. Conclusions them based only on the evidence cited in the book without any attempt to analyze them. The essence of this evidence is based on that of the relation (37) the total energy of the interaction

$$W_A = \frac{1}{2C}\int_v \mathbf{A}\mathbf{j}dV \tag{38}$$

substitution

$$\mathrm{rot}\,\mathbf{H} = \frac{4\pi}{C}\mathbf{j}, \tag{39}$$

is located

$$W_A^{'} = \frac{1}{2C}\int_v \mathbf{A}\,\mathrm{rot}\,\mathbf{H}dV. \tag{40}$$

Thus, taking into account

$$\mathbf{A}\,\mathrm{rot}\,\mathbf{H} = \mathbf{H}\,\mathrm{rot}\,\mathbf{A} + \mathrm{div}[\mathbf{H}\times\mathbf{A}], \tag{41}$$

for (40) permanently installed (in vacuo)

$$W_A^{'} = \frac{1}{8\pi}\int_v \mathbf{HH}\, dV + \frac{1}{8\pi}\oint_s [\mathbf{H}\times\mathbf{A}]dS = \frac{1}{8\pi}\int_v \mathbf{HH}\, dV = W_H\,, \quad (42)$$

where the surface integral over the infinite surface is assumed to be zero. As part of the well-known formalism in electrodynamics, seemingly correctly installed complete equivalence (38) and (42) However, in reality the correspondence between data dependencies exist. To show this, we select from (38) and (42) members of the magnetic interaction $\mathbf{U}_A$ and $\mathbf{U}_H$:

$$U_A = \frac{1}{2C}\int_v \mathbf{A}_1\mathbf{j}_2 dV + \frac{1}{2C}\int_v \mathbf{A}_2\mathbf{j}_1 dV\,, \quad (43)$$

$$U_H = \frac{1}{8\pi}\int \mathbf{H}_1\mathbf{H}_2 dV + \frac{1}{8\pi}\int \mathbf{H}_2\mathbf{H}_1 dV \quad (44)$$

Suppose that we are interested in the interaction energy of the two elements of the current $J_1 D \mathbf{x}_1$ and $J_2 D \mathbf{x}_2$ or elementary charges e_1 and e_2 . In this case (43), the integral is zero integral over the entire space except delta volumes $\mathbf{V}_1$ and delta $\mathbf{V}_2$ occupied by elements of the current $J_1 D \mathbf{x}_1$ and $J_2 D \mathbf{x}_2$:

$$\delta U_A = \frac{1}{2C}\int_{\delta V} \mathbf{A}_1\mathbf{j}_2\, \delta V + \frac{1}{2C}\int_{\delta V} \mathbf{A}_2\mathbf{j}_1\, \delta V \quad (45)$$

or what is the same

$$\delta U_A = \frac{1}{2C}\mathbf{A}_1\mathbf{j}_2\, \delta V + \frac{1}{2C}\mathbf{A}_2\mathbf{j}_1\, \delta V \quad (46)$$

Given The

$$\mathbf{A}_1 = \frac{J_1 dx_1}{Cr_{12}}, \quad \mathbf{A}_2 = \frac{J_2 dx_2}{Cr_{21}}, \quad (47)$$

to (46) can be written

$$\delta U_A = \frac{J_1 J_2}{2C^2}\frac{dx_1 dx_2}{r_{12}} + \frac{J_2 J_1}{2C^2}\frac{dx_2 dx_1}{r_{21}}. \quad (48)$$

Taking into consideration

$$J_1 d\mathbf{x}_1 = \sigma_1 V_1 d\mathbf{x}_1 = (\sigma_1 d\mathbf{x}_1)\mathbf{V}_1 = e_1 \mathbf{V}_1, \quad (49)$$

$$J_2 d\mathbf{x}_2 = \sigma_2 V_2 d\mathbf{x}_2 = (\sigma_2 d\mathbf{x}_2)\mathbf{V}_2 = e_2 \mathbf{V}_2, \quad (50)$$

to (48) set

$$\delta U_A = \frac{e_1 e_2 \mathbf{V}_1 \mathbf{V}_2}{C^2 r_{12}}, \quad (51)$$

which corresponds to the total energy of interaction between two moving charges e_1 and e_2. It is now easy to show that the energy of the magnetic field of a current element $J_1 D \mathbf{x}_1$ is

$$\delta W_A = \frac{1}{2C} \mathbf{A}_1 \mathbf{j}_1 \delta V_1 = \frac{e_1^2 V_1^2}{2 r_0 C^2}. \quad (52)$$

With regard to the magnetic field of the electron energy, taking into consideration

$$m_0 C^2 = \frac{e^2}{r_0}, \quad (53)$$

obtain

$$\delta W_A = \frac{m_0 V_1^2}{2} \equiv W_K, \quad (54)$$

t. e. the energy of the magnetic field delta $\mathbf{W}_A$ (54) is identically equal to the kinetic energy of the electron. However, it is known [85-87] that the self-energy of the magnetic field delta $\mathbf{W}_H$ electron, according to the relationship (42), we have

$$\delta W_H = \frac{1}{8\pi} \int_v H_1^2 dV = \frac{2}{3} W_K. \quad (55)$$

Respectively, and for the energy of the magnetic interaction delta $\mathbf{U}'_A$ (44) between moving charges e_1 and e_2 get

$$\delta U'_H = \frac{1}{8\pi} \int \mathbf{H}_1 \mathbf{H}_2 dV + \frac{1}{8\pi} \int \mathbf{H}_2 \mathbf{H}_1 dV < \frac{e_1 e_2 \mathbf{V}_1 \mathbf{V}_2}{r_{12} C^2} = \delta U'_A. \quad (56)$$

The correctness of the result (56) can be proved by direct calculation, but the integrals in (56) is simply not taken. To estimate the value of the integrals (56) can easily replace the function of the magnetic field

for $H = \frac{eV}{Cr^2}\sin\varphi$ several extended function $H' = \frac{eV}{Cr^2}$, ie, for any integrable space to put **H '** > **H** . In this case, the left-hand side of (56) we have

$$\delta U''_H = \frac{e_1 e_2 V_1 V_2}{C^2 r_{12}}, \qquad (57)$$

equivalent (51). Of the assessment follows directly that provided **H** < **H '** expression for the energy delta **U '** $_A$ (56) will have certainly less important than the expression of delta **U "** $_H$ (57).

Thus, the expression for the energy **W** $_H$ (36) really is not equivalent to the well-known expression for the energy **W** $_A$ (37). However, the question arises, where is the mistake with the seemingly correct transition from (38) to (42)? Easy to see that an important role in this transition has the equation (39). Above is the 2nd part of the review mentioned the presence of a substantial limitation of this equation in the framework of the formalism of the magnetic field. In particular, with respect to current and non-closed single moving charge entry form (39) no longer represents the equation, and is just inequality. But in this case, it is obvious that if the transition from (38) to (42) used the expression (39), which is, in fact, inequality, then the findings of the equivalence expression for the energy (38) and (42) can not be considered correct.

7. The positive results of the experiments the Aharonov-Bohm effect is not disputed by anyone, but experts deny the possibility of the classical interpretation of these experiments, believing, according to long-held beliefs that this phenomenon is only the quantum nature. In this regard, some of these professionals are showing a certain bias critical attitude towards attempts to interpret experiments such as the Aharonov-Bohm effect of a longitudinal magnetic interaction. They mistakenly believe that within the known representations of the positive results of the experience of the Aharonov-Bohm effect does not imply the possibility of the existence of the longitudinal force and effect, the more the second type of magnetic field. Consequently, these experiments can not be considered experimental proof of the existence of the phenomenon of longitudinal magnetic interaction and the second magnetic field. Meanwhile, in contrast to the opinion of experts, we can show that, even without the help of any additions and changes to the provisions of electrodynamics, ie being within the known concepts, the existence of the phenomenon of the power of a longitudinal magnetic interaction can be directly set as the time of the positive results experience Aharonov-Bohm effect. Above , in the 4th part of the review, the analysis of theoretical contradictions 14, 15 have already shown that, without leaving the framework of the known concepts, the need for a longitudinal magnetic interaction phenomena can be easily installed from a well-known in electrodynamics dependencies . Below we give a few more options proof of the necessity of existence of the phenomenon of the power of a longitudinal magnetic interaction between moving along the axis of the toroid current charge with the field of the vector potential in the experience of the Aharonov-Bohm effect, and also obtained within only known representations.

Assume that we have suspended on thin threads ideal current toroid total axial current J_0 and (for simplicity of calculation) without a ferromagnetic core (Fig. 7). All toroidal magnetic field $\mathbf{H}_T \neq 0$, as it is known, is concentrated within it, while the outside of the toroid, there is only non-zero field vector potential $\mathbf{A}_T \neq 0$. Consider moving with velocity **V** along the axis of the toroid in its field vector potential $\mathbf{A}_T$ electric charge q . Without leaving the framework of the known concepts, it is necessary to determine what magnetodynamic forces can act in this case a moving electric charge.

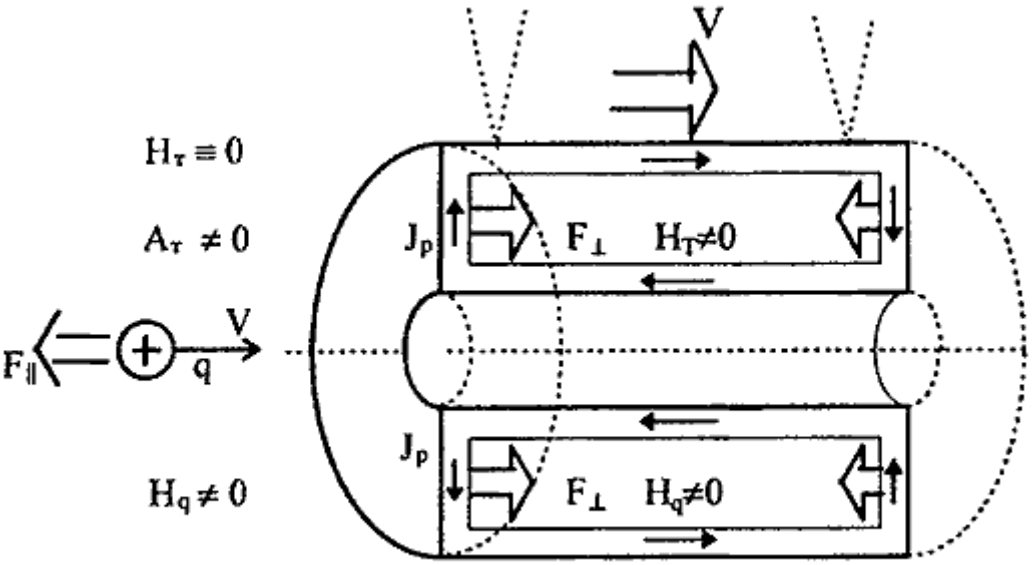


Рис. 7

1) Of the known representations of the Lorentz magnetic interaction between a moving along the axis of the toroid charge q no magnetic forces act shall not:

$$\mathbf{F}_q = \frac{q}{C}[\mathbf{V} \times \mathbf{H}_T] \equiv 0, \tag{58}$$

as is the toroid magnetic field is zero $\mathbf{H}_T \equiv 0$. According to (58), taking into account that the current toroid with a moving charge does not interact, we find that the reaction to the toroid by moving charge from the known laws of mechanics must also be zero. As a result, we establish that the toroid will not change its state of rest on the suspension thread.

However, while remaining within the known concepts of further discussion, we find that the intrinsic magnetic field $\mathbf{H}_q$ moving charge q throughout the surrounding area, including the inside of the toroid, is not zero $\mathbf{H}_q \neq 0$. But in this case, according to the famous views on current toroid will act trivial Lorentz magnetic pressure force

$$\mathbf{F}_T = \frac{J_0}{C}\int [d\mathbf{l} \times \mathbf{H}_q] \neq 0. \tag{59}$$

Moreover, equal and oppositely directed magnetic Lorentz forces $\mathbf{F}_\perp$, acting on the axial currents J_0 toroid, it will be offset by the rigid structure, while the pairwise Lorentz force $\mathbf{F}_\perp$ currents acting on the radial J_P toroid at its ends, provide non-zero resultant force directed along its axis. Under the action of a real magnetic force toroid deviate on the suspension, ie. E., According to known concepts, the toroid will experience the power of the magnetic pressure of the incident to him moving charge q . But then it becomes obvious that, according to the known laws of mechanics to the incident on the toroid electric

charge q is equal and opposite to the direction of the longitudinal reaction force $\mathbf{F}_{\parallel} \neq 0$, which will slow down the charge q , reducing its speed.

At first glance, the situation is identified, it would seem, is the apparent paradoxical, since one known method, we establish that a moving charge q with current toroid should not interact. Whereas the other known the same way we establish the existence between them trivial magnetic interaction forces. Of two mutually exclusive statements obtained at the correct observance of the known laws of electrodynamics, preference should be given to that which establishes the existence of non-zero result, since otherwise would have cast doubt on the correctness of the well-known and well-proven in the electrodynamics of the law of interaction of currents with the magnetic field. Zero same result (58) in this case include, for example, to a particular case or to the case when you do not take into account some additional, but, again, the known forces.

2) Taking into account that the magnetic field $\mathbf{H}_q$ in the space around a moving charge q is not equal to zero throughout the surrounding area, including the inside of the current toroid, according to well-known concepts in electrodynamics, for the interaction energy $\mathbf{W}_H$ magnetic fields $\mathbf{H}_T$ and $\mathbf{H}_q$, can be recorded within the toroid ($\mathbf{H}_T \neq 0$, $\mathbf{H}_q \neq 0$)

$$W_H = \frac{2}{8\pi} \int_{\Delta V} \mathbf{H}_T \mathbf{H}_q \, dV \neq 0 , \tag{60}$$

where ΔV - volume of the inner cavity of the toroid.

From (60) we find that the interaction energy $\mathbf{W}_H$ magnetic field $\mathbf{H}_T$ and $\mathbf{H}_q$ inside the toroid is not zero and is an explicit function of the distance R between the moving charge q and the toroid, since the magnetic field $\mathbf{H}_q$, inside the toroid depends on the distance R charge to the toroid. If so, then the forces of interaction (action and reaction) between the moving charge q and current toroid directly set

$$\mathbf{F}_H = -\frac{\partial W_H}{\partial \mathbf{R}} \neq 0 . \tag{61}$$

Force $\mathbf{F}_H$ (61) can be given a specific physical interpretation. Variable in the toroid additional magnetic flux F_q of the magnetic field H_q moving charge q reduces the magnitude of the total magnetic flux F_0 in the toroid:

$$\Phi_o = \Phi_T - \Phi_q , \tag{62}$$

resulting in the space around the toroid induces eddy electric field induction $\tilde{E}$, according to the other already known relationship:

$$\varepsilon = \oint \tilde{\mathbf{E}} \, d\mathbf{l} = -\frac{1}{C} \frac{\partial \Phi_o}{\partial t} . \tag{63}$$

The direction of the electric field inducing eddy $\tilde{E}$ space around the toroid will then be such that it will seek its action to increase the current J_0 in the toroid and at the same time inhibit enters a toroid electric

charge q . Therefore, once again, without introducing any new ideas about the fields and interactions directly establish that the interaction of a moving charge q with current toroid is not zero.

3) From the well-known concepts in electrodynamics [13] directly establish that the interaction energy $\mathbf{W}_A$ moving charge q and the field vector potential $\mathbf{A}_T$ toroid defined by the relationship

$$W_A = -\frac{1}{C}\mathbf{A}_T q\mathbf{V} . \tag{64}$$

Since the field of the vector potential $\mathbf{A}_T$ in the space around the toroid is non-zero $\mathbf{A}_T \neq 0$ and changes its value when the distance to the toroid, the expression of $\mathbf{W}_A$ (64) for the force $\mathbf{F}_{\parallel}'$ longitudinal interaction of a moving charge q and the field vector potential **And** immediately find

$$\mathbf{F}_{\parallel}' = -\frac{\partial W_A}{\partial \mathbf{R}} \neq 0 . \tag{65}$$

It should be noted that because of the potential relationship (65) is defined as the strength of a current to the toroid and a reaction force on a moving charge. Therefore, once again, without any change entrenched notions in electrodynamics, between a moving charge and current toroid clearly establishes the existence of the phenomenon of longitudinal magnetic interaction.

We can show that to the same same result can be obtained in the case if we consider the total derivative of the vector potential $\mathbf{A}_T$ toroid at the point where moving with velocity V charge q :

$$\tilde{\mathbf{E}}_T = -\frac{1}{C}\frac{d\mathbf{A}_T}{dt} = -\frac{1}{C}\frac{\partial \mathbf{A}_T}{\partial t} - \frac{1}{C}(\mathbf{V}\nabla)\mathbf{A}_T = -\frac{1}{C}(\mathbf{V}\nabla)\mathbf{A}_T . \tag{66}$$

The action is not equal to zero vortex electric field $\tilde{E}_T$ (66) on a moving electric charge q in this case can be determined dependence

$$\mathbf{F}_{\parallel}'' = -\frac{1}{C}(\mathbf{V}\nabla)\mathbf{A}_T q \neq 0 . \tag{67}$$

Since the force $\mathbf{F}_{\parallel}''$ (67) coincides with the direction of motion of the charge q , then the strength of the interaction is longitudinal.

4) Consider the interaction of a moving charge q and the field vector potential from the perspective of the toroid principle of relativity. We now turn to the reference frame moving with the electric charge q . In this case, the charge q will be considered as at rest, and the current toroid inducing vector potential $\mathbf{A}_T$, will be moving in the direction of the charge q . Since the vector potential $\mathbf{A}_T$ toroid at the location of a stationary charge q will change over time, it will cause the appearance of the point where the charge q vortex electric field $\tilde{E}$, defined in electrodynamics known relationship:

$$\tilde{\mathbf{E}} = -\frac{1}{C}\frac{\partial \mathbf{A}_T}{\partial t} \neq 0. \qquad (68)$$

The action of the electric field induced eddy $\tilde{E}$ resting on an electric charge q, in turn, will cause the appearance of forces

$$\mathbf{F}_{\parallel}''' = \tilde{\mathbf{E}}q \neq 0, \qquad (69)$$

acting on the charge q in the direction and along the axis of the toroid along the direction of its movement.

Thus, based on the positive results of the experience of the Aharonov-Bohm effect and staying within the known concepts, as illustrated above, is fundamentally different ways is quite possible again to prove the necessity of the existence of previously unknown phenomena in science longitudinal magnetic interaction. Which implies that the experimentally observed phenomenon of power interaction effect of moving along the axis of the toroid current of electrons with the field of the vector potential in experiments like the Aharonov-Bohm effect is indeed confirm the reality of the phenomenon of longitudinal magnetic interaction. The above is the limitations of the evidence reflected in the fact that they are all set, in general, different sizes of force interaction effects. For example, in the first case, the interaction of a moving charge q perpendicular to the radial currents toroid J_P, but ignored the interaction of the same charge with parallel axial currents J_0 toroid. In the second case, the interaction of the vector magnetic field of the charge $\mathbf{H}_{\perp q}$ and toroid $\mathbf{H}_{\perp T}$, but ignored the interaction of scalar magnetic fields of the charge $\mathbf{H}_{\parallel q}$ and toroid $\mathbf{H}_{\parallel T}$. In the third case we have the usual potential interaction $\mathbf{F}_{\parallel}'$ (65) of the moving charge q parallel currents J_0 toroid in which completely eliminated the interaction with perpendicular radial currents J_P toroid. In the fourth case, the force $\mathbf{F}_{\parallel}''''$ (69) does not take into account the interaction between the moving charge q with the scalar magnetic field $H_{\parallel}$ of the vector potential $\mathbf{A}_{P1}$ and $\mathbf{A}_{P2}$ opposite radial currents J_P toroid. The fact that the sum of the vector potentials $\mathbf{A}_{R1}$ and $\mathbf{A}_{P2}$ on the radial axis of the toroid currents equals zero:

$$\mathbf{A}_{po} = \mathbf{A}_{p1} + \mathbf{A}_{p2} \equiv 0, \qquad (70)$$

Meanwhile, as the total magnetic field H scalar $_{\parallel P}$ from the same vector potentials $\mathbf{A}_{R1}$ and $\mathbf{A}_{P2}$ on the axis of the toroid is non-zero:

$$H_{\parallel p} = \mathrm{div}\mathbf{A}_{p1} + \mathrm{div}\mathbf{A}_{p2} \neq 0. \qquad (71)$$

If we take into account the total scalar magnetic field $H_{\parallel 0}$ the vector potential $\mathbf{A}_0$ axial current toroid and the total scalar magnetic field $H_{\parallel P}$ from the vector potential $\mathbf{A}_{P1}$ and $\mathbf{A}_{P2}$ radial currents toroid, then the full force of the moving charge interaction I have with the current toroid within the framework of new ideas, we have

$$\mathbf{F}_{\parallel}^{o} = \frac{q}{C}\mathbf{V}\left(H_{\parallel p} + H_{\parallel o}\right) = \mathbf{F}_{\parallel p} + \mathbf{F}_{\parallel o}. \qquad (72)$$

From the comparison of the expressions for the force $\mathbf{F}_T$ (59), $\mathbf{F}_{\parallel H}$, (61), $\mathbf{F}_{\parallel}'$ (65), $\mathbf{F}_{\parallel}''$ (69) with a total force $\mathbf{F}_{\parallel}^{\circ}$ (72), we find that these expressions give several underestimated in comparison with $\mathbf{F}_{\parallel}^{\circ}$ value of the force. Clearly from the same negative result $\mathbf{F}_q$ (58) we can conclude that the known, rooted in the electrodynamics of the laws of magnetic interaction and one transverse magnetic forces Lorentz reference to the description of a particular electromagnetic phenomena of reality, are obviously limited.

---

13. IE Tamm Fundamentals of the theory of electricity. - M .: Nauka, 1976. - S. 78 - 83,230,233,370,400.

23. Nikolaev GV The laws of mechanics and electrodynamics near-Earth space. Vol. 1. - S. 541 (R & D. - State. Register. № 74007254, B324555otU. 1974.).

24. Nikolaev GV The limits of applicability of classical and relativistic electrodynamics in near-Earth space. Vol. 2. - P. 164 (R & D. - State. Register. № 74007254, B340882 from X. 1974).

26. Nikolaev GV XI.Electrodynamic phenomena in the motion of the charge in the physical vacuum. - Provision for deposit.

27. Ampere AM Electrodynamics. - Moscow: USSR Academy of Sciences, 1954.

39. Sigalov RT, Shapovalov TI, Karimov HH, Samsonov NI New driving forces of the magnetic field. - Tashkent: FAN, 1975.

67. Nikolaev GV I. Problems of electrostatics empty space / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. №2417-80.

68. Nikolaev GV II. Physical vacuum of real space / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2418-80.

69. Nikolaev GV III. Questions electrostatics physical vacuum Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg №2419-80.

70. Nikolaev GV IV.The equations of electrostatics physical vakuumg real space. - Provision for deposit.

76. Nikolaev GV XII. The equations of electrodynamics of physical vacuum of real space. - Provision for deposit.

77. Nikolaev GV XII. Electrodynamics rapidly moving charge and emission of electromagnetic waves. - Provision for deposit.

83. Kolesnikov PM Electromagnetic acceleration of plasma. - M .: An atom of the dates, 1971.

84. NI Zhirnov Classical mechanics. - M .: Education, 1980. - 38 pp.

85. Frenkel Frenkel Elektrodinamika.-L. M .: ONTI, 1934.

86. Tonnelat MA Fundamentals of electromagnetism and relativity. - Moscow: IL, 1962. C. 55, 86.

87. SV Bellustin Classical electron theory. - M .: Higher School, 1971. - 115 pp.

CONCLUSION

Presented in this review analysis of the current in modern electrodynamics contradictory and paradoxical situation can not be considered fully complete. It would be possible to analyze a number of other assumptions, contradictory consequences, unexplained phenomena of the modern theory of electromagnetism, which also may have some probative value. Could also continue being within the known contradictory ideas, look for new contradictions and paradoxes in modern electromagnetic theory (and, of course, you can find it!), But whether it is necessary to engage in such an infinite analysis contradictory consequences and paradoxes of the theory, if already accumulated known facts both in theoretical and experimental areas so much that further search for them is already simply irrational. If we take into account also that sooner or later the progress in this field of science still lead us to really establish the physical and consistent theory, much more must be considered of little waste of time to search for and analysis of new contradictory consequences of the modern theory of electromagnetism. Currently he is already an urgent need to concentrate the efforts of all professionals to discuss new emerging trends in electrodynamics and in search of the new consistent electromagnetic theory, which would eliminate, at last, all the known contradictions and paradoxes of electrodynamics. However, the main identified to date in modern electrodynamics are numerous contradictions and paradoxes not only lose their original meaning, but also acquire special relevance, serving as a certain test tests for newly developing electromagnetic theory. First of all, the new electromagnetic theory should eliminate all known theoretical contradictions and apparent quantitative differences, some of which is reflected in the third part of the review. Similarly to, for example, differences in the quantitative determination of the interacting forces and energy of charged particles, known under received conflicting representations eliminated new proposed possible embodiment of the electromagnetic theory, in the framework of the two types of magnetic field, the vector of the total magnetic field vector potential gradient fields or distorted electric fields. In addition, the new electromagnetic theory should be easy and natural way to explain all known hitherto known experimental contradictions and paradoxes of electrodynamics, the same way as, for example, they are eliminated as part of new views of two types of magnetic fields, the total magnetic field vector, the vector potential gradient fields deformed and electric fields. Of course, not ruled out the possibility of still other new theoretical approaches in the already well-known in the mathematical formalism of the electrodynamics of the magnetic field $\mathbf{H} = \mathrm{ROT}\ \mathbf{A}$ formal or vector potential field in the form $\mathbf{A}' = \mathbf{A} + \mathbf{cp}\nabla$, and so on. d. However, a review of the analysis in a sufficiently fully shows significant limitations and obvious futility of this formalism.

Cited in the review of the general physical and theoretical results and experimental evidence for the reality of existence, except for well-known in the science of the vector magnetic field $\mathbf{H}_{\perp} \mathrm{ROT} = \mathbf{A}$, another scalar magnetic field $\mathbf{H}_{\parallel} = -\ \mathrm{div}\ \mathbf{A}$, in quite fully reflect the natural complementarity and unity of the nature of these fields. The resulting general physical and logical completeness of the submission of the full magnetic properties of a moving charge, in turn, led to the establishment of the possibility of constructing a sufficiently strict and consistent electrodynamics of two types of magnetic fields. Nevertheless, from the point of view of a distant perspective, even when explicit positive side, the proposed new formalism of two types of magnetic fields, as well as a more complete understanding of the full vector magnetic field gradient and electric fields are largely abstract and still not physically fit. New theoretical approaches to the electrodynamics can be sufficiently physically really only if the theory is to consider those physical processes that link the charge and the electric field induced by them with the physical vacuum surrounding real space, and will also take into account the nature of the change in this regard, the state of motion of an electric charge in the physical vacuum, etc. Therefore, now is the urgent need to focus all efforts on finding specialists of this particular physical relationship of the electric charge and the electric field induced by them with the medium of the physical vacuum of real space. You need to decide finally, the problem of getting rid of electrodynamics, optics, mechanics

and physics in general all of the forced use in these fields abstract inherently non-physical representations of the principle of action at a distance. Determination of the nature of the physical vacuum, elucidation of the physical properties of the vacuum as a special material environment, taking into account its discrete and charge structures [67-70] and the internal dynamic properties will put on the agenda the discussion of topical issues of modern physics as determining the specific nature of the phenomenon of the transfer of all types of interactions a distance physics of the phenomenon of electromagnetic, gravitational, and other types of wave processes in space, determine the nature of the electric, magnetic, gravitational and other fields and the specific physics of these fields in their ability to concentrate considerable potential energy in space. And the most interesting problems in the physics of the physical vacuum is the problem of determining the dynamic characteristics of the vacuum environment [26, 76, 77], the dynamics of the discrete structure and charge properties, the definition of the form of equations of state and electrodynamic equations for the vacuum of the environment, and so on. D.

It should be noted the critical role of the physical vacuum environment on a global scale in relation to everything around us near-Earth, space and metagalactic space [23, 24]. Undoubtedly, an important role among the physical vacuum will play in the establishment of a unified physical theory of material bodies, media and fields. It is necessary to have openly admit that the problem of the physical vacuum surrounding real space is currently one of the most urgent problems of all modern physics.

REFERENCES

1. "crazy theories? Before it is still far .." // Knowledge is power. - 1978. - № 11.- S. 24.

2. Technique youth. - 1968. - №12; 1969. - №8; 1974. - №12; 1974. - №1; 1982.-№3; 1984.-№1.

3. Engineering and Science. - 1983. -№ 2, 10, 11; 1984.-№1.

4. Inventor. - 1982. - №2; 1981. - № 6; 1982. -№ 10; 1984.-№2.

5. Okolotin VS This electric world // Knowledge, Science in your profession. - 1984. - №2.

6. VS Okolotin The most important task for superconductors. - M: Knowledge, 1983.

7. Feynman R., Leighton R., Sands M. The Feynman Lectures on Physics, Vol. 5. - M .: Mir, 1977. - S. 152 - 172.

8. Feynman R., Leighton R., Sands M. The Feynman Lectures on Physics, Vol. 6. - M .: Mir, 1977. - S. 15 - 30.

9. Neiman LR, KS Demirchian Theory of Electrical Engineering, Vol.2. - L .: Energy, 1975. - S. 270 - 276.

10.Nikolaev GV 1. Displacement currents and radial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep VINITI, reg. № 3487-78.

11. Purcell E. Electricity and Magnetism. - M .: Nauka, 1971. - 265 pp.

12. Levich, VG Course of Theoretical Physics, Vol 1 - M .: Nauka, 1969.-S. 32.45, 104-110.

13. IE Tamm Fundamentals of the theory of electricity. - M .: Nauka, 1976. - S. 78 - 83,230,233,370,400.

14. J. Maxwell. Selected works on the theory of the electromagnetic field. - M .: Gostekhizdat, 1954.

15. Nikolaev GV IV. Justification of the reality of the axial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 528-79.

16. Nikolaev GV VIII. On the nature of the vortex electric field gradient moving charge. - Dep. VINITI, reg. № 5812-85.

17. Observation of the Aharonov - Bohm // Nature. - 1983. - № 7. - S. 106.

18. M. Danos effect Aharonov - Bohm quantum mechanics electrical transformer // Physics abroad. Ser. B. - M .: Mir, 1984. - S. 100-105.

19. darling BN The theory of the effect Aharonov - Bohm. - Dep. VINITI, reg. № 2931-80.

20. Solunin AM R-electrodynamics and the effects of the vector potential. - Dep. VINITI, reg. № 5416-85.

21. Nikolaev GV II currents bias and radial magnetic field of a linear current / Ed. Zh."Proceedings of the universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 3488-78.

22. Nikolaev GV V. The system of equations for the axial (scalar) and radial (vector) magnetic fields of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2664-80.

23. Nikolaev GV The laws of mechanics and electrodynamics near-Earth space. Vol. 1. - S. 541 (R & D. - State. Register. № 74007254, B324555otU. 1974.).

24. Nikolaev GV The limits of applicability of classical and relativistic electrodynamics in near-Earth space. Vol. 2. - P. 164 (R & D. - State. Register. № 74007254, B340882 from X. 1974).

25. GV Nikolaev, Okulov BV On the inertial properties of the electrons / Ed. Zh."Math. Universities. Physics." - Tomsk, 1978. - Dep. VINITI, reg. № 4399-77.

26. Nikolaev GV XI.Electrodynamic phenomena in the motion of the charge in the physical vacuum. - Provision for deposit.

27. Ampere AM Electrodynamics. - Moscow: USSR Academy of Sciences, 1954.

28. Alechinsky VG On the question of the impact of the current formula electrodynamic elements // Math. universities.Electromechanics. - 1980. - №4.- S. 431 -434.

29. Sinelnikov EM, Sinel'nikov DE Ponderomotive interaction of two elementary bodies in a quasi-stationary magnetic field // Math. universities.Electromechanics. - 1976. -№1. - S. 13-18.

30. Sinelnikov DE, Sinel'nikov EM Formula for determining the force interaction current elements // Math. universities.Electromechanics. - 1978. - №3. - S. 227 - 235.

31. Gade VV Conformal version of Maxwell's equations and the Lorentz. - Novosibirsk, 1985 / Preprint, USSR Academy of number 588.

32. Solunin AM K-Electrodynamics // Interuniversity collection of ISU, Ivanovo, 1982. - Dep. VINITI, reg. № 3908-82.

33. Nikolaev GV On the laws of electrodynamics and optics in rotating frames of reference relative to the Earth / Red. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 2911-74.

34. GV Nikolaev, Okulov BV On the exponential justify the principle of relativity / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 3064-74.

35. Nikolaev GV The paradox of Feynman and asymmetry laboratory and moving reference frames / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 1937-75.

36. Nikolaev GV Hall effect and the asymmetry of the laboratory and the moving reference frames / Ed. Zh."Math. Universities. Physics." - Tomsk, 1975. - Dep. VINITI, reg. № 2507-75.

37. Nikolaev GV On the Limitations of classical and relativistic electrodynamics in the conditions on the surface of the Earth / Red. Zh."Math. Universities. Physics." - Tomsk, 1976. - Dep. in VNITI, reg. № 3277-75.

38. Nikolaev GV On checking the fundamental relations in the satellite / Ed. Zh."Math. Universities. Physics." - Tomsk, 1976. -Dep. VINITI, reg. № 3429-75.

39.Sigalov RT, Shapovalov TI, Karimov HH, Samsonov NI New driving forces of the magnetic field. - Tashkent: FAN, 1975.

40. Pappas PT The Original Ampere Force and Biot-Savart and Lorenz Forces // H.Nuovo cimento. 11 Agosto. - 1983. - V. 76B. - № 2. - P. 189

41. Graneou P. Electromagnetic jet-propulsion in the direction of carrent flow // Nature. - 1982. - V. 295. - № 5847. - P. 311 - 313.

42. 1. Science News. - 1982. - V. 121. - .№ 7. - P. 104.

43. Okolotin VS, Rumyantsev DE Experiments Grano: the power of number 4 or focus? // Engineering and Science. - 1983. -№11. - S. 26 -27.

44. Nikolaev GV Second magnetic field // Engineering and Science. - 1984. - №1. -C. 42 -43.

45. A. Rodin Fog over the magnetic field // Inventor and ratsionalizator.- 1982. -№ 2. - S. 18-19.

46. V. Chernikov As I met with the evil spirit // Technique youth. - 1974. - №1. - P. 37.

47. EA Shtrauf Electricity and Magnetism. -M .: Publishing House of the TTL, 1950. - S. 91,98,348.

48. Frisch SE, AV Timoreva General physics course. T. 2. - M .: Publishing House of the TTL, 1957.-S. 68.

49. AS Kompaneetc Theoretical physics. -M .: Publishing House of the TTL, 1957. - S. 126-128.

50. Nikolaev GV IX.Vortex electric field is rapidly moving charge and the laws of inertia charges. - Dep. VINITI, reg. № 5813-85.

51. SI Vavilov Works. 4. T. - M .: AN SSSR, 1954.

52. Sagnac G .// Compt. rend. - 1913. - V. 157.-P. 508.

53. Pogany P .// Ann. Phys.- 1926. -V. 80. -P. 217 -231.

54. Macec WM Davis DT // Appl. Lett.-1963. -V. 2. - P. 67-68.

55. Landau LD, Lifshitz EM Field theory. - M .: Nauka, 1973.

56. Cedarholm IP, Bland GF, Haven BL, Tawnes CH // Phys. Rev. Lett. - 1958. - V. 1. - P. 342 - 343.

57. Iaseja TS, laven A., Murray I., Tawnes CH // Phys. Rev. Lett.- 1964. - V. 133a. - P. 1221 - 1223.

58. Champney DC, Moon PB // Proc. Phys. Soc.- 1961. - V. A77. - P.350 -351.

59. Champney DC, Isaac GP, Khan M .// Phys. Lett.- 1963. - V. 7. -P. 241- 243.

60. Cialdia P .// Lett. Nuovo cim. - 1972. - V. 4. - № 16. - P. 821 - 825.

61. Nikolaev GV Optical and near-Earth space electrodynamic asymmetry // Application for opening, № 32-RT-8857 of 1975

62. GV Nikolaev, Okulov BV Lavrov MD A device for measuring the speed, mobility and concentration of the sign carriers of electric current in a solid // Application for invention. AS Number of 13.06.77g 661,656. Bull. Number 17, 1979.

63. GV Nikolaev, Petrik VA device for measuring the angular velocity of rotation of the object // Application for invention. AS Number of 19.12.78g 777,581. Bull. №41, 1980.

64. Nikolaev GV Korshunov GS Spark gap // Application for invention. AS Number 913,494 by 07/21/80, the Bull. Number 10, 1982.

65. Solunin AM, Kostin AV On the effect of the potential for a toroidal solenoid. - Dep. VINITI, reg. № 7900-84.

66. Nikolaev GV Property of a moving charge to induce an axial magnetic field is a scalar // Application for opening, № 32-OT-10663 from 19.09.82g.

67. Nikolaev GV I. Problems of electrostatics empty space / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. №2417-80.

68. Nikolaev GV II. Physical vacuum of real space / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2418-80.

69. Nikolaev GV III. Questions electrostatics physical vacuum Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg №2419-80.

70. Nikolaev GV IV.The equations of electrostatics physical vakuumg real space. - Provision for deposit.

71. Nikolaev GV Electrostatics physical vacuum // Report on the meeting of the Section of Physics Moscow Society of Naturalists, "Theory and practice of experimental studies of the physical vacuum", M, May 1979.

72. Nikolaev GV III. Bias currents and axial magnetic field of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1979. - Dep. VINITI, reg. № 592-79.

73. Nikolaev GV VI. The system of equations for vortex electric fields are uniformly and rapidly moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2665-80.

74. Nikolaev GV VII. The system of equations for the gradient of the electric fields of a moving charge / Ed. Zh."Math. Universities. Physics." - Tomsk, 1980. - Dep. VINITI, reg. № 2666-80.

75. Nikolaev G.V.H. The wave equation for the vortex electric and two types of vortex magnetic fields rapidly moving charge. - Dep. VINITI, reg. № 5814-85.

76. Nikolaev GV XII. The equations of electrodynamics of physical vacuum of real space. - Provision for deposit.

77. Nikolaev GV XII. Electrodynamics rapidly moving charge and emission of electromagnetic waves. - Provision for deposit.

78. Nikolaev GV Bias currents of the vacuum environment and the magnetic field of a moving charge // Report on the meeting of the physics section of Moscow Society of Naturalists, "Theory and practice of experimental studies of the physical vacuum." - M., May, 1979.

79. Solunin A. M .// Math. universities. Physics. - 1972.-№7.-C. 107.

80. Avramenko RF, Grachev LP, Nikolaeva VI Description of the electromagnetic field with the potentials and problems of transmitting information // International Symposium on Information Theory. -A., 1976.

81. Avramenko RF, Nikolaev VI, Pushkin VN On the question of information interaction isolated systems without energy transfer // Problems of Mental Health, psychophysiology, sociology of labor in the coal industry and psychoenergetics: Sat. - M., 1980. - S. 341-357.

82. KA Trukhanov The vector potential of the electromagnetic field // Electromagnetic fields in the biosphere: Sat. - M .: Nauka, 1984. - Vol.1 - S. 331 - 350.

83. Kolesnikov PM Electromagnetic acceleration of plasma. - M .: An atom of the dates, 1971.

84. NI Zhirnov Classical mechanics. - M .: Education, 1980. - 38 pp.

85. Frenkel Frenkel Elektrodinamika.-L. M .: ONTI, 1934.

86. Tonnelat MA Fundamentals of electromagnetism and relativity. - Moscow: IL, 1962. C. 55, 86.

87. SV Bellustin Classical electron theory. - M .: Higher School, 1971. - 115 pp.

88. Atsyukovsky VA Introduction to Etherodynamics. - Dep. VINITI, reg. № 2760-80.

89. TI Shaovalova Electrodynamics: experiments for problem-based learning. - Tashkent: Ukituvchi, 1985.

90. Kuhn T. The Structure of Scientific Revolutions. - M .: Progress, 1977. - P. 59.

91. Nikolaev GV Unipolar current generator - AS N 1064845 from 06.29.82, the

92. Nikolaev GV .-- "MHD generator" - AS N 1228759 ot02.02.83 city

93. Nikolaev GV Korshunov GS, complicating VV - "Managed spark gap with laser ignition" - Ac. N1194231 from 5.01.84g.

94. Nikolaev GV .-- "Linear motor" - Ac. N 1226579 from 13.06.84g.

95. Nikolaev GV Korshunov GS, complicating VV .- "Managed spark gap" - Ac. N 1264799 from 30.12.84g.

96. Nikolaev GV - "The discharge chamber to form a plasma compression and" Ac. N 1248525 from 11.10.84, the

97. Nikolaev GV - "Electromagnetic pump" - Ac. N 1313303 from 13.02.85, the

98. GV Nikolaev, Krasnyatov JA, Schneider VB, complicating VV - "The electrodynamic rail accelerator" - AS N 4122598 from 02.07.86, the

99. Nikolaev GV - Device for magnetization of the fluid. "- Application N95114277 / 25 05.08.1996g.-patent N2121115

100. Nikolaev GV, GN Novikov .. - Fan-ozonizer. The decision to grant a patent on the invention application N96108283 / 06 (013,666) with a priority from 23.04.96, the - Patent N2121115